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Air Quality Assessment Studies  
For the City of Sault Ste. Marie (1970 - 1975)

June 1976



Ontario

Ministry  
of the  
Environment

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Air Quality Assessment Studies  
For the City of Sault Ste. Marie (1970 - 1975)

By

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Ontario Ministry of the Environment

Northeastern Region

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## I. Introduction:

The Ontario Ministry of the Environment has been monitoring the ambient air quality in the city of Sault Ste. Marie for a number of years. In 1962, an ambient air quality monitoring network was initiated in Sault Ste. Marie with the installation of a high volume air sampler at the Province of Ontario Building situated at the intersection of MacDougald and Albert Streets. Since then the monitoring network has expanded considerably in order to measure the levels of other air pollutants in that community.

In 1975 the network was comprised of the following: 2 high volume air samplers, 17 dustfall jars, 1 coefficient of haze measuring instrument, 10 sulphation candles and 5 fluoridation candles. The majority of these monitors have been located in proximity to Algoma Steel Corporation Ltd. to monitor the particulate and gaseous air pollutants being emitted by the steel mill. In addition to the monitoring of air pollutants at the fixed network stations, mobile monitoring of gaseous pollutants and suspended particulate matter was carried out by Ministry personnel from the Technology Development and Appraisal Section, Monitoring and Instrumentation Development Unit, Air Resources Branch, in January and February 1975.

In order to present a comprehensive picture of the ambient air quality in the city of Sault Ste. Marie, the data collected from these monitoring devices since the inception of the monitoring network will be presented in this report. Annual means were computed in order to determine variations in the levels of air pollutants at different locations throughout the city, and also to determine trends in these levels as a function of time. A number of figures are included in the appendix in order to present these variations in a concise form.

The data indicate that the levels of total dustfall are frequently excessive at certain locations in Sault Ste. Marie. Since 1972, the levels have been generally increasing in that community. On the other hand, the values of suspended particulates have decreased appreciably since 1971 at a downtown location in that city. In 1975 the levels measured at a location adjacent to the Algoma Steel plant repeatedly exceeded the Ontario criterion for total suspended particulates. Analyses of high volume filters for benzo(a)pyrene and benzo(k)fluoranthene indicate that the levels of these substances have been occasionally elevated, especially at locations adjacent to the steel plant, although the province of Ontario has not as of yet set an ambient air criterion for these hydrocarbon compounds.

The sulphation rate data show that the levels of sulphur dioxide have been low in Sault Ste. Marie since the inception of the lead peroxide candle survey. The fluoridation rate data indicate that the levels of fluorides have exceeded the acceptable value at some locations in that city on a number of occasions. The number of excessive readings increased slightly in 1975.

Air Quality Assessment staff have also conducted vegetation, soil (1974-1975) and snow (1975-1976) sampling programs in Sault Ste. Marie. Chemical analysis of these samples shows that in the immediate vicinity of the steel mill, the levels of a number of elements are elevated over the levels of the same elements in similar samples collected at control locations.

## II. Vegetation and Soil Sampling 1974 and 1975:

### (a) Program Outline:

In September of 1974, foliar samples of white birch were collected at 5 locations in the city of Sault Ste. Marie and a control site approximately 70 km east of the city. The samples were analyzed, on a washed basis, for total sulphur, arsenic, calcium, chloride, iron, magnesium, zinc and fluoride. Samples of soil, 0-5 cm and 5-10 cm were collected at each of the five sampling sites in the city and the control location. Each soil sample consisted of a composite sample of twenty cores and the samples were analyzed for the same elements as the foliar samples. A pH measurement was taken on all the soil samples.

The vegetation and soil sampling program which was initiated in 1974 in Sault Ste. Marie was continued, with certain modifications in 1975. Triplicate foliar samples of white birch were collected at 4 locations in August in the city and at a control location 160 km east of the city. Triplicate soil samples were collected at 5 locations in the city and a control location. The foliar samples were analyzed on a non-washed basis, for total sulphur, iron, zinc, arsenic, fluoride and chloride. The soil samples were analyzed for calcium, magnesium and pH as well as the previously listed elements. The locations of the sampling sites are shown in Figure 1. The vegetation in Sault Ste. Marie was examined monthly during the 1974 and 1975 growing season for acute visible air pollution injury.

### (b) Results:

The results of the chemical analysis of white birch foliage show that within approximately 1.5 km of the steel plant the levels of total sulphur, arsenic, iron, zinc and fluoride are consistently elevated over the levels found at the 2.5 km and 70 km (control) collection sites (Tables 1 and 2). Although elevated, the levels of most of these elements are not considered to be excessive. However, those levels of iron greater than 1000 ppm; the two zinc concentrations of 470 ppm and 930 ppm; and the fluoride reading of 77 ppm are considered to be excessive. Although these elements were found to be higher than those in the control samples no visible air pollution injury was noted on vegetation in the vicinity of the steel mill.

The concentrations of total sulphur, arsenic, iron, zinc and fluoride in the soil samples were elevated at the sites closest to the steel mill when compared to the control location (Tables 3 and 4). However, none of the soil levels are considered to be excessive. Also no definite pattern existed with regard to the levels of the various chemicals and the depth of soil. The low levels of calcium and magnesium at the control sites are indicative of poor soil fertility at these more remote locations. The levels of soil chloride are all less than the detection limit of .02%. The pH of the soil samples collected in the city are generally higher than those at the control locations. This is a reflection of the better buffer capacity of the city soils which, as noted earlier, contained higher levels of calcium and magnesium than the control samples.

## III. Snow Sampling Program (1975 and 1976):

### (a) Program Outline:

Snow samples were collected for chemical analysis at a number

of sites in Sault Ste. Marie and a control location during January of 1975 and 1976. The locations of the sampling sites are shown in figure 2.

In 1975, at each sample location, five circular cores of snow (18 cm deep and 8 cm in diameter) were collected and allowed to melt overnight at room temperature. The five snow melt water samples were then combined and a pH measurement was taken. However in 1976 the samples consisted of circular cores of snow (8 cm in diameter) and represented a complete profile of the snow from the surface to the ground level. The samples were taken in such a manner as to avoid contamination by ground materials. The number of cores required to fill 4.5 kg polyethylene bags was recorded. The samples were returned to melt overnight at room temperature in the polyethylene bags. A pH measurement was taken on the melt water.

For both 1975 and 1976 the samples were divided into two equal portions and one of these portions was preserved by the addition of 2 ml of nitric acid. The acidified portion of the sample was analyzed for iron, lead, calcium (1975) and zinc, while the sulphate, arsenic, fluoride, chloride and sodium analyses were performed on the non-acidified portion.

#### (b) Results:

The results of the chemical analyses show that close to the steel mill (within 1.5 km), the levels of iron, zinc, arsenic, calcium, sulphate and fluoride were elevated when compared with the levels in the control samples. In general the levels of these elements decreased with distance from the steel mill, however most of the samples collected in the city contained greater concentrations of the named elements than were found in the control sample. The levels of sodium and chloride were influenced by the application of road salt and the lead levels were found to be low in nearly all cases. The pH of the samples collected near the steel mill had been buffered upwards by the presence of various particulate materials and calcium salts. A maximum pH of 10.2 was recorded at a collection site 0.3 km west of the mill. The snow sampling results are shown in tables 5 and 6.

#### Conclusions:

The results of the chemical analysis of vegetation, soil and snow samples collected at various locations in Sault Ste. Marie during 1975 and 1976 indicate that the emissions of the Algoma Steel Corporation steel plant have caused elevated concentrations of a number of chemical elements in the three types of samples collected. In general, the concentrations of arsenic, iron, zinc, fluoride and sulphate were highest in samples collected close to the steel plant and decreased with increased distance from the plant. The concentrations of all chemical elements were higher in the samples collected in the city than in the sample collected at a control location, 70 km east of Sault Ste. Marie.

#### IV. Air Quality Monitoring Network:

The air quality monitoring network in Sault Ste. Marie was initiated in 1962 with the installation of a high volume air sampler at the Province of Ontario Building located at the corner of MacDougal and Albert Streets. In 1970, the monitoring network was expanded with the addition of 10 sulphation candles. The locations of the candles are as follows: Beaver Hotel (Queen St. W.), Anna McRea Public School, James Lyons Public School, Alexander Henry High School, Bayview Public School, Holy Angels Separate School, Our Lady of Lourdes Separate School,

Franklin St. Public School, S. F. Howe Public School and the Province of Ontario Building (MacDougald and Albert Streets). The following year, the network was further expanded with the installation of 5 fluoridation candles at these sites: Beaver Hotel, Bayview Public School, Our Lady of Lourdes Separate School, Franklin St. Public School and the Province of Ontario Building.

In 1970, a coefficient of haze monitor was installed at the Province of Ontario Building in order to complement the total suspended particulates survey at that location. In July 1975, the Province of Ontario Building station at the corner of MacDougald and Albert Streets was relocated to the Land Registry Office on Queen Street since it was felt that the latter location would be more appropriate for monitoring the levels of air pollutants in that area of the city. This new location is located approximately 2 blocks northeast of the former site.

Also in July 1975 additional dustfall jars were installed on public utilities poles at the following locations: Bonney Street, Wilding Street and Wallace Terrace, Korah Road and Wallace Terrace, Adelaide Street, Fairview Avenue, Peoples Road and the Sault Locks. At that time, a high volume air sampler was set up adjacent to the pumphouse on Bonney Street.

The approximate locations of these monitoring instruments are illustrated in figure 3 on page 21. For the sake of simplicity, the sites are identified numerically. A list of the site numbers together with the respective station locations and addresses appears in table 7 on page 47.

#### V. Ambient Air Monitoring of Particulates:

The levels of airborne particulate matter in the city of Sault Ste. Marie have been monitored on a regular basis since the early 1970's. The monitoring methods that have been and are currently being used are that of total dustfall, high volume sampling and soiling index.

The amount of dustfall comprised of the larger size particulates which settle to the ground under the influence of gravity, is measured by exposing open top plastic containers of specified dimensions (20" high and 5" diameter) to the atmosphere for a period of 30 days. The total dustfall loading is determined by weighing the container before and after exposure. The contents of the dustfall jars can also be analyzed for the presence of soluble matter and also for various elements such as heavy metals. The levels of dustfall are expressed in tons/mile<sup>2</sup>/30 days.

The amount of suspended particulate matter in the air is quantitatively determined by sampling a large volume of air with a high volume sampler. Approximately 1.5 cubic meter of air per minute is drawn through a preweighed glass fiber filter. The filter is then weighed to determine the amount of suspended particulates deposited. In this manner the total weight of the suspended particulates per unit volume of air sampled is determined. The elemental composition of the particulates can also be determined by atomic absorption. The results are expressed in micrograms of particulates/meter<sup>3</sup> of air sampled.

The soiling index is used to determine the amount of suspended particulates in the air and is set to provide hourly or 2-hourly readings which can be transmitted by telemetry (if necessary). The fundamental

basis of evaluating the sample is optical. The transmittance of light through both filter and deposit is compared with the transmittance through a clean portion of the filter. This difference in transmittance is converted into units of coefficient of haze (COH) per 1000 linear feet of air passing through the filter.

(A) Dustfall Measurements:

(i) Total Dustfall:

The monthly total dustfall levels for the period July 1970 to December 1975 at the 10 locations shown in figure 3 on page 21 (sites 1 to 10) are presented in tables 8 to 17 on pages 48 to 57. All the values are expressed in tons/mile<sup>2</sup>/30 days. Over this 6 year period, the levels of dustfall have been consistently elevated at the Beaver Hotel and the Bayview Public School locations with 6 year means of 32 and 37 tons/mile<sup>2</sup>/30 days respectively. The levels of dustfall were also frequently excessive at the Province of Ontario Building, S. F. Howe Public School and Holy Angels Separate School with average dustfall levels between 13 and 15 tons/mile<sup>2</sup>/30 days during that period of time. The mean dustfall levels from 1970 to 1975 for the 10 locations are represented graphically in figure 4 on page 22.

The annual mean dustfall levels and the number of times for which the monthly criterion was exceeded are shown in table 20 on page 59. The superscripts indicate the number of months for which the averages were taken when less than 12 months of data were available. In Ontario the monthly criterion for dustfall is 20 tons/mile<sup>2</sup>/30 days. The data indicate that the criterion was exceeded on 55 occasions at site 1 (Beaver Hotel) and on 45 occasions at site 5 (Bayview Public School) representing approximately 84% and 70% of the total number of monthly samples collected at these locations respectively. From the table, it is seen that at the other locations the criterion was exceeded on significantly fewer occasions. At site 4 (Alexander Henry High School), the monthly criterion was never exceeded since the inception of the dustfall monitoring network. Thus for these 10 dustfall jar locations, sites 1 and 5 comprised 79% of the total number of times for which the monthly criterion was exceeded.

The following table lists the number of years for which the annual criterion was exceeded at the above locations. In Ontario the annual criterion for dustfall is 13 tons/mile<sup>2</sup>/30 days.

<u>Site No.</u>	<u>No. of Years Above the Annual Criterion From 1970 to 1975</u>
1	6
2	NIL
3	1
4	NIL
5	6
6	2
7	NIL
8	1
9	2
10	3
TOTAL	21



The annual criterion was exceeded every year since 1970 at sites 1 and 5. At site 10 (Province of Ontario Building) the criterion was exceeded during 3 years, whereas at sites 6 (Holy Angels Separate School) and 9 (S. F. Howe Public School) the criterion was exceeded during 2 years. At sites 2 (Anna McRea Public School), 4 (Alexander Henry High School) and 7 (Our Lady of Lourdes Separate School) the criterion was never exceeded during the 6 year period.

Since 1972 the levels of dustfall have remained fairly constant at sites 3 and 4, whereas the levels at the other locations have generally increased as shown in table 20. This increasing trend in the levels of dustfall becomes more evident when the means of the annual averages from 1970 to 1975 are calculated for all the stations. This is again shown in table 20 and also in figure 5 on page 23. The data indicate that since 1972 the levels of dustfall in Sault Ste. Marie have generally increased: the average levels in 1972 were 12 tons/mile<sup>2</sup>/30 days whereas the levels in 1973, 1974 and 1975 were 14, 17 and 17 tons/mile<sup>2</sup>/30 days respectively. This trend with time is further substantiated by the increase in the number of times that the monthly criterion has been exceeded since 1972.

The monthly mean dustfall values were also computed for all the sites for the 1970 to 1975 period. The results are shown in tables 8 to 17 and are also graphically represented in figures 6 to 10 on pages 24 to 28. It can be observed that at most locations the levels of dustfall follow a strong seasonal variation with lower levels in January, February, March, October, November and December, and somewhat more elevated levels from April to September. This variation in the dustfall levels is frequently observed in the absence of particulate emissions from industrial sources. However at sites 1, 5 and 9, as indicated on pages 24, 26 and 28, the levels have remained elevated throughout the year. This indicates that particulate matter has continually been emitted in the immediate area of the dustfall jars. Figure 3 indicates that these jars are located in the immediate vicinity of Algoma Steel Corporation Ltd.

The monthly dustfall data for the 7 jars installed in July 1975 are shown in table 18 and 19 on pages 57 and 58. The mean levels and the number of times above the monthly criterion for these sites are summarized in table 21 on page 60. For the period of time during which data were collected the mean dustfall levels at these locations exceeded the annual criterion of 13 tons/mile<sup>2</sup>/30 days. The levels were especially excessive at site 12 (Bonney St.) with a 6 month average of 47 tons/mile<sup>2</sup>/30 days. The lowest mean was recorded at site 17 (Peoples Rd.). At Bonney St. the monthly criterion was exceeded every month, whereas at the Peoples Rd. location the criterion was not exceeded.

At some of the other locations (13, 14, 16 and 18) the levels were frequently excessive.

#### (ii) Elemental Analysis:

In 1975, the contents of some of the dustfall jars were analyzed for the heavy metals copper, iron, nickel and zinc and also for arsenic, cadmium and lead. The results of these analyses are summarized in tables 22 and 23 on page 61. In all instances iron comprised the largest fraction of the dustfall followed by zinc and lead. The levels of copper, nickel, arsenic and cadmium were very low. The jars at Beaver Hotel and Bayview Public School had the highest levels of iron in the total dustfall with values ranging between 1.7 and 11.7 tons/mile<sup>2</sup>/30 days.

(iii) Microscopic Analysis:

The insoluble portion of the dustfall jar contents for stations 1, 2 and 5 were examined microscopically for the months of May, June and July 1975 by Ministry personnel at the Physical Methods Laboratory, Laboratory Services Branch. The constituents examined were carbon, iron oxide and silica<sup>1</sup>. The presence of these constituents are expressed as a percentage given by the area percent occupied by each type of material when uniformly distributed on a microscopic slide. The results are presented below:

<u>Station</u>	<u>Month</u>	<u>Constituents (%)</u>		
		<u>Carbon</u>	<u>Silica</u>	<u>Iron Oxide</u>
Beaver Hotel	May	90	10	trace
	June	50	50	--
	July	50	50	--
Anna McRea Public School	May	30	70	--
	June	15	85	--
	July	20	80	--
Bayview Public School	May	100	--	--
	June	95	--	5
	July	100	--	--

Hence it appears that the dustfall jar located at Bayview Public School contained the largest percentage of carbonaceous material of the type generally associated with steel making operations such as coke, coal and graphitic carbon. The jar at Beaver Hotel also contained a substantial amount of carbonaceous material.

(B) High Volume Sampling:(i) Total Suspended Particulates:

The levels of suspended particulate matter have been monitored in the city of Sault Ste. Marie since 1962 with a high volume air sampler located at the Province of Ontario Building on the corner of MacDougald and Albert Streets. From 1962 to 1968 the sampler was operated on the first 3 to 4 days of each month for 24 hr. periods. Hence for those years, the levels of suspended particulates were probably not representative of the levels for the month during which the sampling was performed. Nevertheless the annual geometric means were computed and will be compared to the means for the other years during which the sampler was operated on the regular 6 day survey (i.e. the sampler is operated for a period of 24 hours every sixth day).

A summary of the levels of total suspended particulates (TSP) measured at the above location from 1962 to 1975 is shown in table 24 on page 62 together with the number of times that the 24 hr. criterion was exceeded in each year. From the table it is seen that total loadings on the filters as high as 625 and 648  $\mu\text{g}/\text{m}^3$  were measured during this 14 year period. A total of 537 samples were collected over that time period. The Ontario criterion for TSP (120  $\mu\text{g}/\text{m}^3$  for a 24 hr. sampling period) was exceeded for 125 samples, i.e. for approximately 23% of the total number of samples.

Since 1970 the annual geometric mean levels of TSP at the Province of Ontario Building have been lower than in previous years. This is substantiated by the fact that during the past 6 years the annual criterion was exceeded only once (1972), whereas in the previous 8 years the annual criterion was exceeded each year. In 1974 and 1975 the geometric means were 49 and 41  $\mu\text{g}/\text{m}^3$  respectively, the lowest means reported for the 14 years of high volume sampling. The number of times that the 24 hr. criterion has been exceeded has noticeably decreased since 1971. Hence since about 1970 the levels of TSP at that location decreased appreciably.

In July 1975, the high volume sampler at the Province of Ontario Building was moved to the Land Registry Office on Queen St. The sampling frequency was not altered such that the sampler was operated on a 6 day schedule. The data for TSP are presented in table 25 on page 63 for the period July 17 to December 26. The geometric mean for the 23 samples collected in the first half of the year at the former location was 41  $\mu\text{g}/\text{m}^3$  as indicated in table 24 on page 62. The 24 hr. criterion was exceeded twice in September with values of 130 and 146  $\mu\text{g}/\text{m}^3$ .

In July 1975 a high volume air sampler was installed adjacent to the Bonney St. pumphouse in the immediate vicinity of the Algoma Steel Corp. Ltd. installations (site 12 in figure 3). This sampler is operated on a 3 day schedule such that from 10 to 12 filters per month were exposed from July to December. The data for TSP are shown in table 26 on page 64. A total of 64 samples were collected. Total particulate loadings as high as 415 and 419  $\mu\text{g}/\text{m}^3$  were obtained during 24 hr. sampling periods in July and November respectively. The 24 hr. criterion of 120  $\mu\text{g}/\text{m}^3$  was exceeded 26 times representing about 40% of the total number of samples. For that time period the geometric mean for TSP was 87  $\mu\text{g}/\text{m}^3$  which exceeds the annual criterion of 60  $\mu\text{g}/\text{m}^3$ . The geometric mean was also computed for each month as indicated in the following table:

<u>Month (1975)</u>	<u>Geometric Mean (<math>\mu\text{g}/\text{m}^3</math>)</u>
July	155
August	115
September	60
October	108
November	80
December	49

It is seen that the levels were highest in July, August and October and lowest in December.

#### (ii) Elemental Analysis:

Since 1969 some of the high volume filters from the Province of Ontario Building sampler were analyzed for various elements by the method of atomic absorption. A summary of these analyses is presented in table 27 on page 66. For some of these elements, for example for beryllium, manganese, selenium, silver and vanadium only a few filters were analyzed. The table also lists the Ontario Ministry of the Environment (O.M.E.) criterion for the elements. At the present time there are no criteria for calcium, iron, selenium and zinc. The data show that the levels of these elements for which criteria have been developed, were well within the existing criteria.

The high volume filters from the Land Registry Office sampler on Queen St. were analyzed for heavy metals as shown in table 25 on page 63.



A summary of the elemental analysis is shown in the following table:

<u>Element</u>	<u>No. of Samples Analyzed</u>	<u>Max. 24 Hr. Value (<math>\mu\text{g}/\text{m}^3</math>)</u>	<u>24 Hr. Criterion (<math>\mu\text{g}/\text{m}^3</math>)</u>
Cd	21	0.01	2.0
Cu	21	0.79	5.0
Fe	21	14.4	No Criterion
Ni	21	0.04	2.0
Pb	21	1.70	5.0
Zn	21	0.80	No Criterion

From the table it is observed that the levels were well below the existing criteria. Although these figures are only for a 6 month period, it appears that the levels of these elements are comparable to the levels measured at the previous site (Province of Ontario Building) prior to the re-location of the sampler.

(iii) Sulphate and Nitrate Analysis:

The filters from the above station were also analyzed for total sulphates and total nitrates in the suspended particulates for the years 1969 to 1971. The data for this analysis are presented below. The values are again in micrograms/meter<sup>3</sup>.

Total Sulphates:

<u>Year</u>	<u>No. of Samples Analyzed</u>	<u>Max. 24 Hr. Value (<math>\mu\text{g}/\text{m}^3</math>)</u>	<u>Geometric Mean (<math>\mu\text{g}/\text{m}^3</math>)</u>
1969	32	54.9	8.8
1970	26	50.0	6.5
1971	17	11.1	6.8

Total Nitrates:

<u>Year</u>	<u>No. of Samples Analyzed</u>	<u>Max. 24 Hr. Value (<math>\mu\text{g}/\text{m}^3</math>)</u>	<u>Geometric Mean (<math>\mu\text{g}/\text{m}^3</math>)</u>
1969	32	6.9	1.1
1970	26	8.4	1.5
1971	17	3.6	0.8

The results indicate that the levels of total sulphates were higher than those of total nitrates in suspended particulate matter over the 3 years for which this analysis was performed. Values as high as 54.9 and 50.0  $\mu\text{g}/\text{m}^3$  of total sulphates in TSP were found in 1969 and 1970. Over the 3 year period the levels of sulphates and nitrates remained fairly constant, although in 1971 the levels of nitrates appeared to have gone down slightly.

(iv) Benzo-A-Pyrene and Benzo-K-Fluoranthene Analysis:

In 1971 the Air Quality Laboratory, Laboratory Services Branch, had developed an analytical method suitable for determining and monitoring two im-

portant polynuclear aromatic hydrocarbons (PAH) in suspended particulates. These hydrocarbons are benzo(a)pyrene and benzo(k)fluoranthene. A survey program was initiated in July 1971 for measuring these compounds in the atmosphere of eleven urban communities in the province of Ontario. The city of Sault Ste. Marie was selected as one of the survey centres.

In essence, the analytical method involves the extraction of the organic portion of air particulate material trapped on high volume filters with a suitable solvent. The extract is then fractionated sufficiently by complex chromatographic procedures in order to permit quantitative determination of the compounds thus separated.

In Sault Ste. Marie some of the filters from the high volume air sampler located at the Province of Ontario Building were analyzed for the presence of benzo(a)pyrene (BaP) and benzo(k)fluoranthene (BkF). The data collected from 1971 to 1975 is shown in table 28 on page 67.<sup>2</sup> The results are expressed in micrograms/1000 meter<sup>3</sup> of air sampled. These results are further summarized in the following table.

Year	No. of Samples	Max. Values (ug/1000 m <sup>3</sup> )		Average Values (ug/1000 m <sup>3</sup> )	
		BaP	BkF	BaP	BkF
1971	9	1.16	1.03	0.34	0.38
1972	14	22.5	34.0	1.91	2.91
1973	20	1.80	11.3	0.28	1.02
1974	30	3.89	5.49	0.46	0.84
1975	15	1.28	1.60	0.30	0.40
TOTAL	88		MEAN	0.66	1.11

A total of 88 filters were analyzed for these compounds during this 5 year period. During this survey the levels of BaP and BkF in suspended particulate matter were highest in 1972 with maximum values of 22.5 and 34.0 ug/1000 m<sup>3</sup> for BaP and BkF respectively and average values of 1.91 and 2.91 ug/1000 m<sup>3</sup> for BaP and BkF respectively. In each year of the survey the average levels of BkF were higher than the average levels of BaP. Over the survey period the average level of BaP was 0.66 ug/1000 m<sup>3</sup> whereas that of BkF was 1.11 ug/1000 m<sup>3</sup>.

When the high volume sampler was moved from the Province of Ontario Building to the Land Registry Office in July 1975, the filter analysis for BaP and BkF was continued on a regular basis. The data collected at this new location are shown in table 29 on page 71. A total of 11 samples were collected in 1975. The maximum recorded level of BaP was 2.15 ug/1000 m<sup>3</sup> whereas the maximum level of BkF was 5.07 ug/1000 m<sup>3</sup>. As was the case for the filters from the previous station, the maximum levels of these compounds were obtained on the same filter indicating a close interdependency in their formation and presence in airborne particulate matter.

The filters from the high volume air sampler installed on Bonney St. in July 1975 were also analyzed for the presence of BaP and BkF. Table 30 on page 72 contains a summary of the data collected at that location. Fifteen filters were analyzed for these compounds. Average values of 10.8 ug/1000 m<sup>3</sup> for BkF were obtained during the sampling period from July to December. Maximum values of 58.3 and 85.3 ug/1000 m<sup>3</sup> were reported for BaP and BkF respective-

ly. These levels are considerably more elevated than those measured at the Land Registry Office location. For ease of comparison the above figures for both locations are shown in the following table.

<u>Station</u>	<u>Max. Value (ug/1000 m<sup>3</sup>)</u>		<u>Average Values (ug/1000 m<sup>3</sup>)</u>	
	<u>BaP</u>	<u>BkF</u>	<u>BaP</u>	<u>BkF</u>
Land Registry Office	2.15	5.07	0.63	1.3
Bonney St.	58.3	85.3	10.8	13.9

The Bonney St. monitoring station is located adjacent to Algoma Steel Corp. Ltd. whereas the Land Registry Office station is removed from the company installations as shown in figure 3 on page 21.

(v) Benzo-A-Pyrene and Benzo-K-Fluoranthene Analysis: (Special Study)

In January and February 1975, the Mobile Sampling Unit from the Technology Development and Appraisal Section, Air Resources Branch surveyed the air quality in the area surrounding the Algoma Steel Plant in Sault Ste. Marie. No significantly high levels of gaseous pollutants such as sulphur dioxide, hydrogen sulphide, hydrocarbons and oxides of nitrogen were found. Nineteen high volume filter samples were exposed and 13 of these samples were selected at random for the determination of the levels of polynuclear hydrocarbons (BaP and BkF). The results of this study<sup>4</sup> appear in table 31 on page 73. Some of the values were among the highest ever recorded in Ontario since the inception of the survey for BaP and BkF in July 1971. Indeed maximum values of 152 ug/1000 m<sup>3</sup> for BaP and 216 ug/1000 m<sup>3</sup> for BkF were obtained from a filter that was exposed to only 1/10 of the regular air volume normally sampled during the customary 24 hr. sampling period. For the 13 samples analyzed, the average levels were 24.4 and 41.6 ug/1000 m<sup>3</sup> for BaP and BkF respectively.

The high volume filters from the Bonney St. and Land Registry Office stations will continue to be analyzed for BaP and BkF as part of the regular ambient air monitoring survey plan for the city of Sault Ste. Marie in order to follow the trends in the levels of these pollutants in that community as a function of time. The Ministry of the Environment has approached the Ministry of Health for advice with regard to setting a criteria for the levels of these pollutants in the ambient air.

(C) Soiling Index:

A coefficient of haze (COH) monitor was installed at the Province of Ontario Building station in Sault Ste. Marie in August 1970. Samples at that location were taken every 2 hours. The filter tapes were subsequently analyzed by Ministry personnel of the Air Quality and Meteorology Section, Air Resources Branch in Toronto.

The record of valid data collected during the period August 1970 to July 1975 is shown in the following table.

<u>Year</u>	<u>Days of Valid Data</u>	<u>% Valid Data</u>
1970	56	42
1971	255	74
1972	202	63
1973	240	76
1974	345	92
1975	<u>133</u>	<u>86</u>
	TOTAL 1231	MEAN 72

A total of 1231 days of valid data were collected during that time period. As indicated in the table this represents a data collection efficiency of approximately 72%. This figure is mostly a reflection of instrumentation problems encountered in the course of the sampling program. From past experience at other locations where soiling index is measured, valid data is collected on the average at least 85% of the time.

The yearly group frequency classification for the period August 1970 to July 1975 appears in the table below. The readings for the different ranges of COH values are 2-hourly readings.

<u>Year</u>	<u>0 - 0.4</u>	<u>0.5 - 1.0</u>	<u>1.1 - 2.0</u>	<u>2.1 - 3.0</u>	<u>Total</u>
1970	485	129	15	0	629
1971	2317	619	52	2	2990
1972	1607	668	60	2	2337
1973	2429	343	29	3	2804
1974	3469	545	23	0	4037
1975	<u>1530</u>	<u>44</u>	<u>2</u>	<u>0</u>	<u>1576</u>
	11837	2348	181	7	14373

It can be observed that the majority (98%) of the readings were below 1.0 COH unit. The province of Ontario does not have a 2 hr. criterion for soiling but does have a 24 hr. and an annual criterion: the 24 hr. criterion is 1.0 COH unit whereas the annual criterion is 0.5 COH unit. Table 32 on page 74 indicates that the criteria were not exceeded during this 5 year period although elevated 24 hr. average values were recorded in 1970, 1972 and 1973. The majority of the maximum 24 hr. average values were recorded during the period October to March whereas the maximum 2 hr. values occurred at different times of the year indicating no apparent seasonal dependence. The table also shows that the annual average levels of coefficient of haze have been decreasing since 1973. This is in agreement with the high volume sampling results ( see table 24 on page 62) which indicate

that the levels of suspended particulates have been falling concurrently.

The average monthly coefficient of haze levels were computed and are presented in table 33 on page 75. The means were not computed when less than 66% of the data was available. The maximum monthly average was 0.45 COH and was recorded in December 1970 and in March and May 1972. The mean levels for the 5 year period were also computed on a monthly basis and are also presented in the table. The results are also plotted in figure 11 on page 29. In general the levels of particulates were somewhat lower during the March to September period although in May the levels were more elevated. It is believed that incineration of domestic fuel during the colder months was responsible for the higher levels of suspended particulates.

The annual hourly average COH values from 1970 to 1975 were computed and are shown in table 34 on page 76. The mean for each sampling time interval was also determined and the results are indicated in the table and also in figure 12 on page 30. The coefficient of haze remained fairly constant with the time of day although slightly more elevated levels were observed at 0800 and 1000 hours and also after 1600 hours. Although the data were not separated according to the seasons, this trend in the levels of suspended particulates with the time of day probably resulted from increased vehicular activity in the mornings and from domestic fuel combustion furnaces in the evenings.

#### VI. Sulphation Rates:

From 1970 to 1975, the sulphation rate survey consisted of 10 lead peroxide candles distributed in the city of Sault Ste. Marie as indicated in figure 3 (sites 1 to 11). The candle at site 10 was moved to site 11 when the Province of Ontario Building station was relocated in 1975. The lead peroxide candles monitor the rate of formation of sulphur trioxide ( $\text{SO}_3$ ) and hence give an indication of the levels of sulphur dioxide in the ambient air. The sulphation rates are expressed in milligrams of  $\text{SO}_3/100 \text{ cm}^2$  of exposed candle surface/day. The candles are exposed to the atmosphere for a period of 30 days. At the present time the Ontario criterion for sulphation is 0.7 mgm  $\text{SO}_3/100 \text{ cm}^2/\text{day}$  averaged over a period of 30 days.

The data for sulphation rates during the period 1970 to 1975 are presented in tables 35 to 44 on pages 77 to 86. From the tables it can be observed that the rates were relatively low. The mean rates for this 6 year period were computed for each location and are plotted in figure 13 on page 31. The rates of sulphation were more elevated at the Bayview Public School (site 5) and Beaver Hotel (site 1) stations with mean rates of 0.34 and 0.29 mgm  $\text{SO}_3/100 \text{ cm}^2/\text{day}$ . At the other locations the mean rates were all less than or equal to 0.21 mgm  $\text{SO}_3/100 \text{ cm}^2/\text{day}$ . The lowest average values were recorded at sites 2 and 3 (Anna McRea and James Lyons Public School respectively).

Table 46 on page 87 shows the annual mean sulphation rates and the number of times the criterion was exceeded for each location for the period 1970 to 1975. The superscripts are again indicative of the number of samples for which the means were calculated when there were less than 12 samples in a year. The data indicate that the sulphation rates have remained fairly constant at all locations since 1970. The current criterion (0.7 mgm  $\text{SO}_3/100 \text{ cm}^2/\text{day}$ ) has been marginally exceeded only on 3 occasions over this time period: twice at site 1 and once at site 5. Prior to 1975 the criterion for sulphation in Ontario was 0.4 mgm  $\text{SO}_3/100 \text{ cm}^2/\text{day}$ . The number of times that the former criterion was exceeded were computed and are shown in the following table.

Site No.	No. of Times Above the Former Criterion*						Total
	1970	1971	1972	1973	1974	1975	
1	1	2	2	2	2	4	13
2	1	NIL	NIL	NIL	NIL	NIL	1
3	NIL	NIL	NIL	NIL	NIL	NIL	NIL
4	1	2	NIL	NIL	NIL	NIL	3
5	3	5	3	2	2	5	20
6	1	1	1	NIL	NIL	NIL	3
7	NIL	NIL	NIL	NIL	NIL	NIL	NIL
8	NIL	NIL	NIL	NIL	NIL	1	1
9	1	1	2	NIL	NIL	NIL	4
10	2	3	2	1	NIL	NIL	8
11	-	-	-	-	-	NIL	NIL
TOTAL	10	14	10	5	4	10	53

\* Ontario criterion (prior to 1975): 0.40 mgm SO<sub>3</sub>/100 cm<sup>2</sup>/day (30 day period)

The old criterion was exceeded on 53 occasions from 1970 to 1975 in Sault Ste. Marie. The criterion was most frequently exceeded at sites 5, 1 and 10 during this time period, and was never exceeded at sites 3 and 7.

The mean sulphation rates for each month at each station for the 6 year period were computed and the results are presented in figures 14 to 18 on pages 32 to 36. In all instances the rates were lower from April to September indicating that the ambient levels of SO<sub>2</sub> were more elevated during the colder months when sulphur bearing domestic fuel is consumed for heating purposes.

## VII. Fluoridation Rates:

Five fluoride candles were installed in Sault Ste. Marie in 1971 as mentioned earlier at sites 1, 5, 7, 8 and 10. The fluoride candle at site 10 was relocated in 1975 to site 11. The fluoridation rates are determined by exposing these lime candles to the ambient air for 30 days, in much the same manner that sulphation rates are determined with lead peroxide candles. Fluoridation rates are expressed in micrograms of total fluoride/100 cm<sup>2</sup> of limed candle surface/30 days.

The results for the period 1971 to 1975 are shown in tables 47 to 52 on pages 88 to 92. The rates were usually more elevated at sites 1 and 5 as illustrated in figure 19 on page 37, with mean fluoridation rates of 30 and 32 ug F/100 cm<sup>2</sup>/30 days respectively. The annual mean fluoridation rates and the number of times the criterion was exceeded are summarized in table 53 on page 93. The superscripts have the usual meaning. The average levels of fluorides were somewhat more elevated in 1971, the year the fluoride survey was initiated, but only 4 months data were available for the determination of the mean values. From 1972 to 1975 the levels did not appear to vary appreciably. In Ontario the criterion for fluoridation is 40 ug F/100 cm<sup>2</sup>/30 days from April 15 to October 15 and 80 ug F/100 cm<sup>2</sup>/30 days from October 16 to April 14. The lower figure during the growing season is based on vegetation damage and secondary effects on animals via forage. From table 53 it is ob-



served that the criterion has been exceeded on 20 occasions since 1971. The majority of excessive readings (approximately 70%) were recorded at sites 1 and 5 (Beaver Hotel and Bayview Public School). Sixteen of the excessive readings were recorded during the growing season. For all locations the criterion was exceeded on 7 occasions in 1973 and on 8 occasions in 1975. Thus although the average levels of fluorides appear to have remained fairly constant since 1971 the frequency of excessive readings has increased since 1972.

The average monthly values of fluoridation rate are presented in figures 20 to 22 on pages 38 to 40. Unlike the sulphation values, the levels of fluorides do not follow a seasonal pattern, with the more elevated readings occurring randomly during the year. The high values recorded in January and December at sites 1 and 5 resulted from excessive levels in December 1971 and January 1972 at these locations with fluoridation rates between 100 and 170 ug F/100 cm<sup>2</sup>/30 days. In Sault Ste. Marie the main source of fluorides is the Algoma steel plant.

### VIII. Acknowledgements:

The authors wish to express their thanks to: Mr. W. J. Gibson, Manager, Technical Support Section and Dr. D. Balsillie, Chief, Air Quality Assessment for supervision, advice and support; Dr. S. N. Linzon and staff of the Phytotoxicology Section, Air Resources Branch for technical advice and handling of the vegetation and soil samples; Mr. A. C. Rayner and the staff of the Air Quality Laboratory for chemical analysis of the vegetation, soil and snow samples (Mr. R. Wills, J. Bishop and S. Villard); Dr. B. Foster and Mr. M. Metzger, Air Quality Laboratory, for analysis of the lead peroxide and lime candles, dustfall jars and high volume filters; Dr. J. Pimenta, Air Quality Laboratory for the microscope analysis of dustfall; Dr. E. G. Adamek, Air Quality Laboratory Section, for analysis of the high volume filters for benzo(a)pyrene and benzo(k)fluoranthene; Mr. L. Shenfeld and Mr. N. Jain and their staff from the Air Quality and Meteorology Section for reading the coefficient of haze tapes and for compiling the air quality data; Dr. E. Singer, Air Resources Branch, and his staff for the mobile monitoring study in Sault Ste. Marie; the Industrial Abatement Staff at the Sault Ste. Marie district office for their assistance in the monitoring programs and in the collection of the air quality data; Mr. K. Waldie, Technical Support and his staff for maintenance of air quality sampling equipment, and finally to Miss T. Karolewski and Mrs. J. Hatton for secretarial assistance. The presentation of this report was made possible as a result of the co-ordinated effort of all these people.



IX. Bibliography:

1. Pimenta, J., Ministry of the Environment, Laboratory Services Branch, memorandum to Mr. W. J. Gibson, Ministry of the Environment, Manager Technical Support, Northeastern Region, October 21, 1975.
2. Adamek, E. G., 1976. A Two-Year Survey of Benzo(a)Pyrene and Benzo(k) Fluoranthene in Urban Atmospheres in Ontario. Laboratory Services Branch, Ontario Ministry of the Environment, 207 pp.
3. Report on Ambient Air Quality in Espanola and Sault Ste. Marie (January-February 1975 and June 1975), Report No. 24-76 February 1976, Air Resources Branch, Ontario Ministry of the Environment.
4. Adamek, E. G., Ministry of the Environment, Laboratory Services Branch, memorandum to Dr. F. Frantisak/Dr. E. Singer, Ministry of the Environment, Air Resources Branch, July 11, 1975.

## X. A P P E N D I X

FIGURE 1: LOCATIONS OF SAULT STE. MARIE VEGETATION AND SOIL SAMPLING SITES 1974 AND 1975.

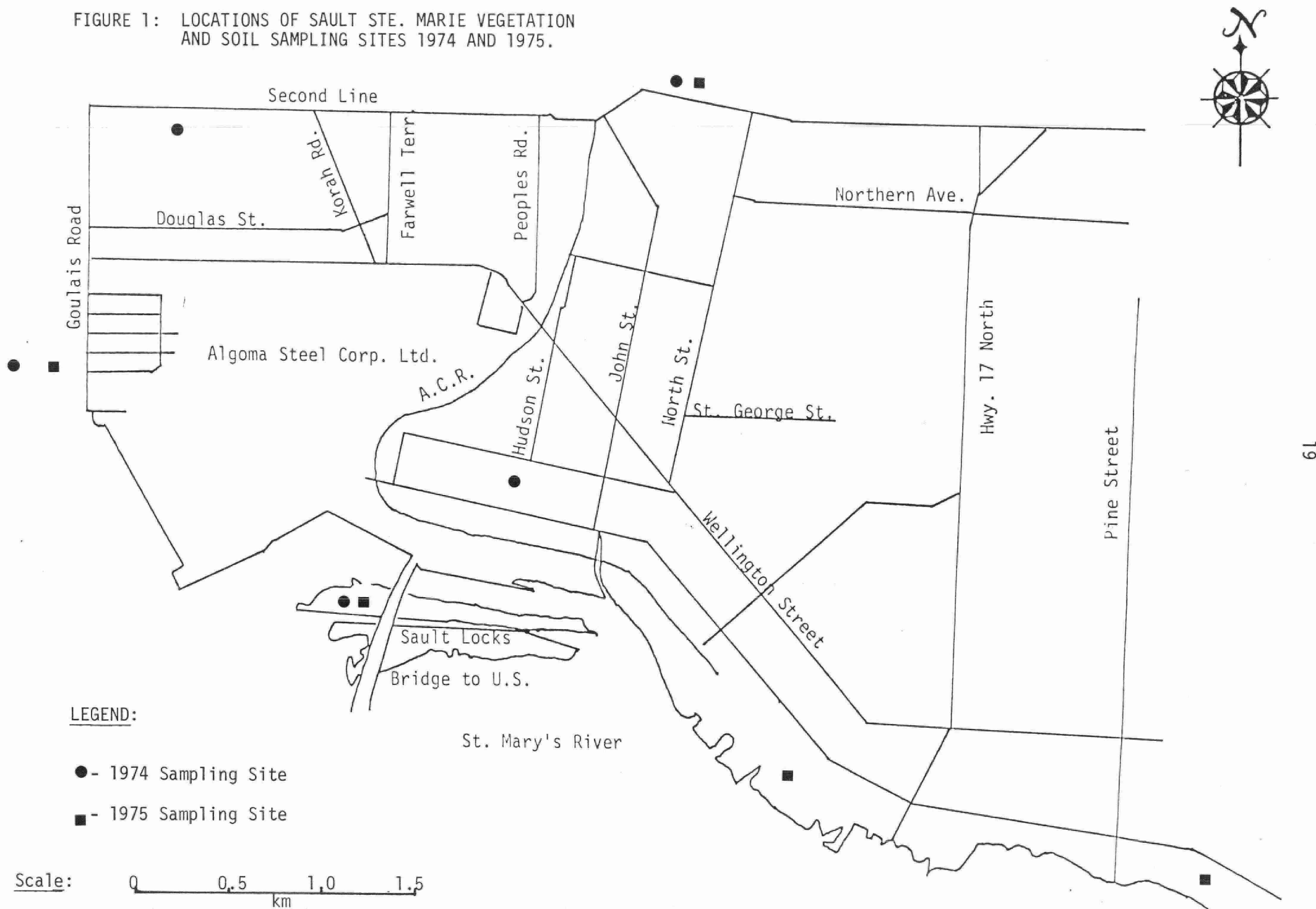
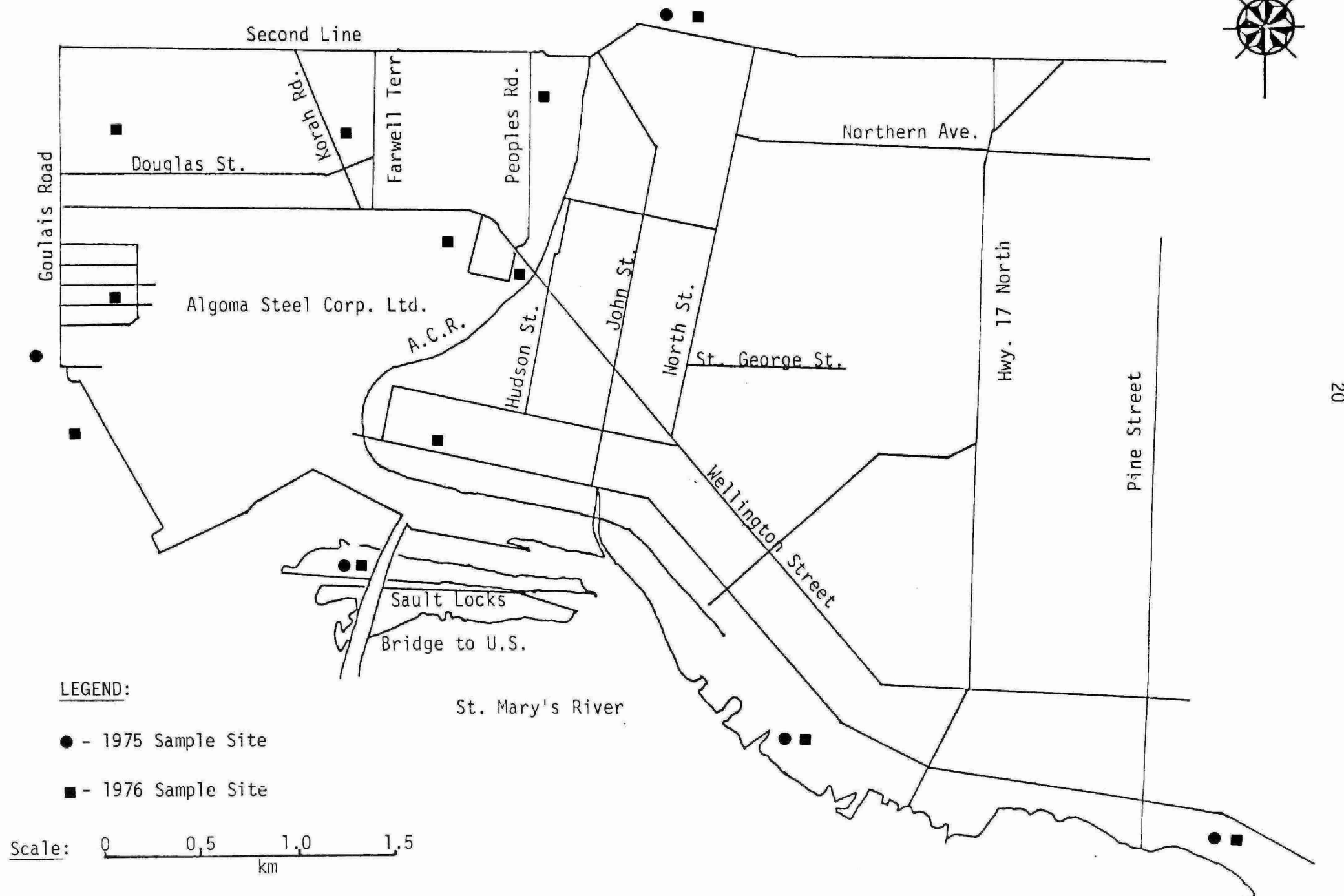


FIGURE 2: LOCATIONS OF SAULT STE. MARIE SNOW SAMPLING SITES 1975 AND 1976.



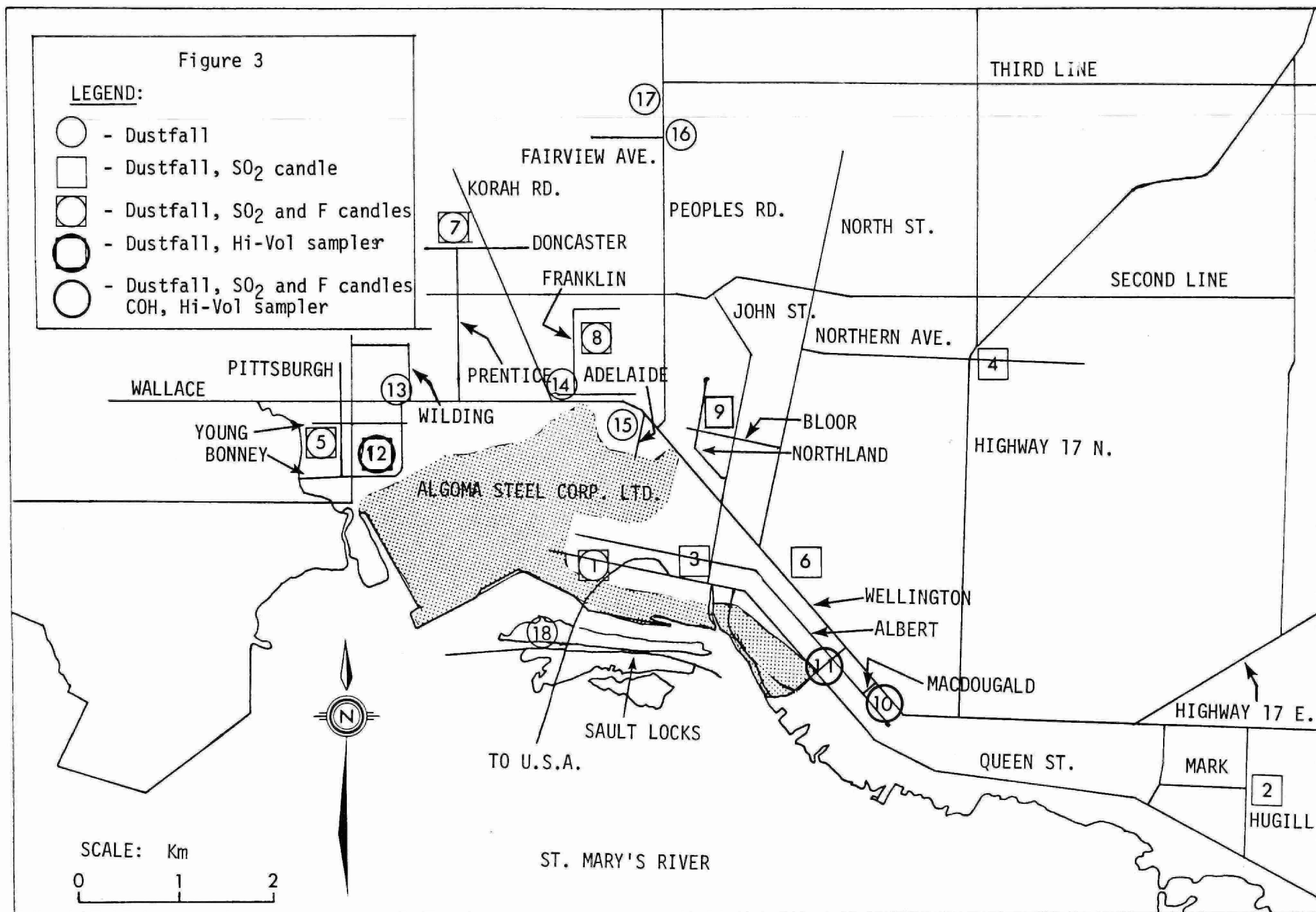


FIGURE 4  
AVERAGE DUSTFALL LEVELS AT LOCATIONS  
IN SAULT STE. MARIE FROM 1970 TO 1975

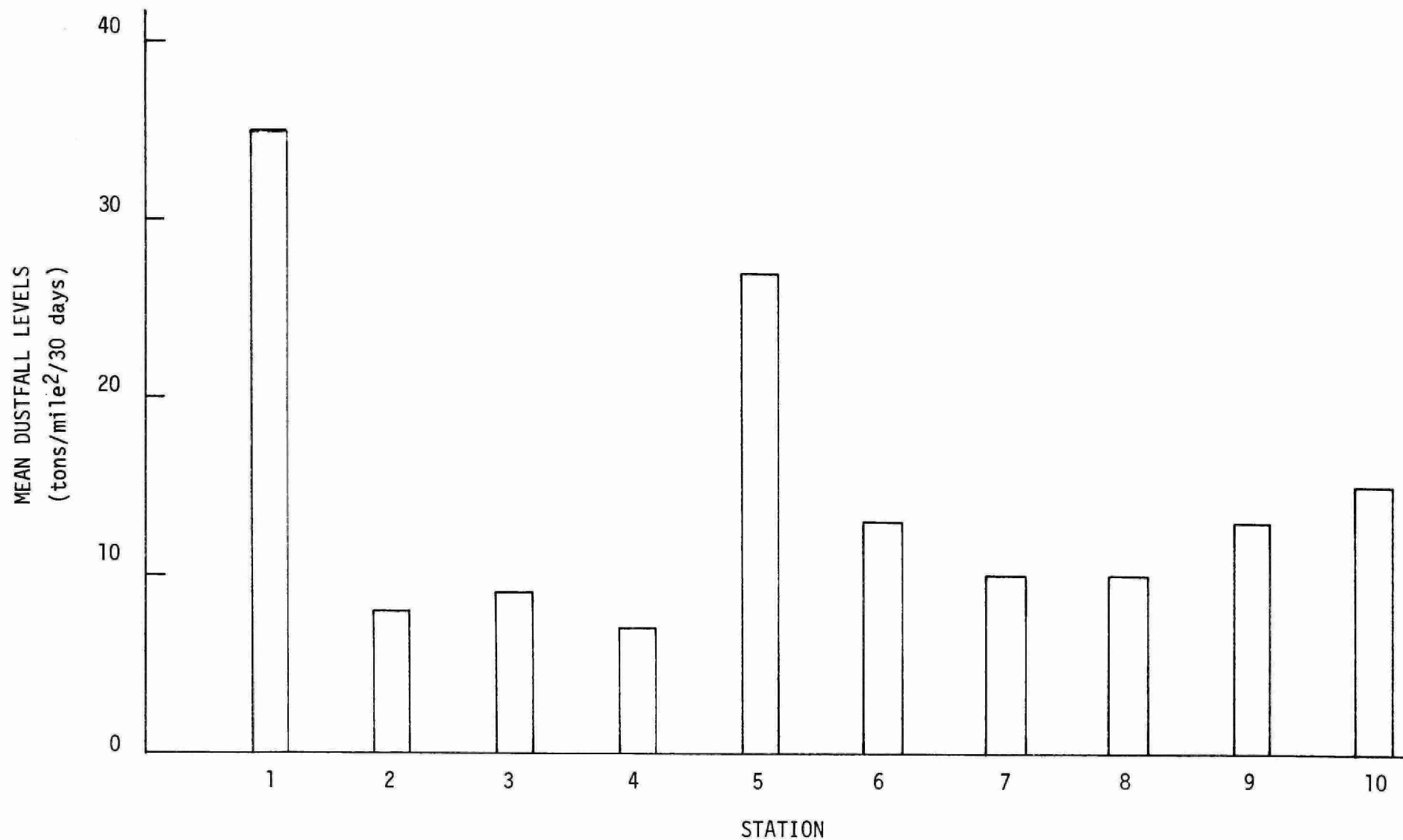


FIGURE 5  
ANNUAL MEAN DUSTFALL LEVELS AT LOCATIONS  
IN SAULT STE. MARIE FROM 1970 TO 1975

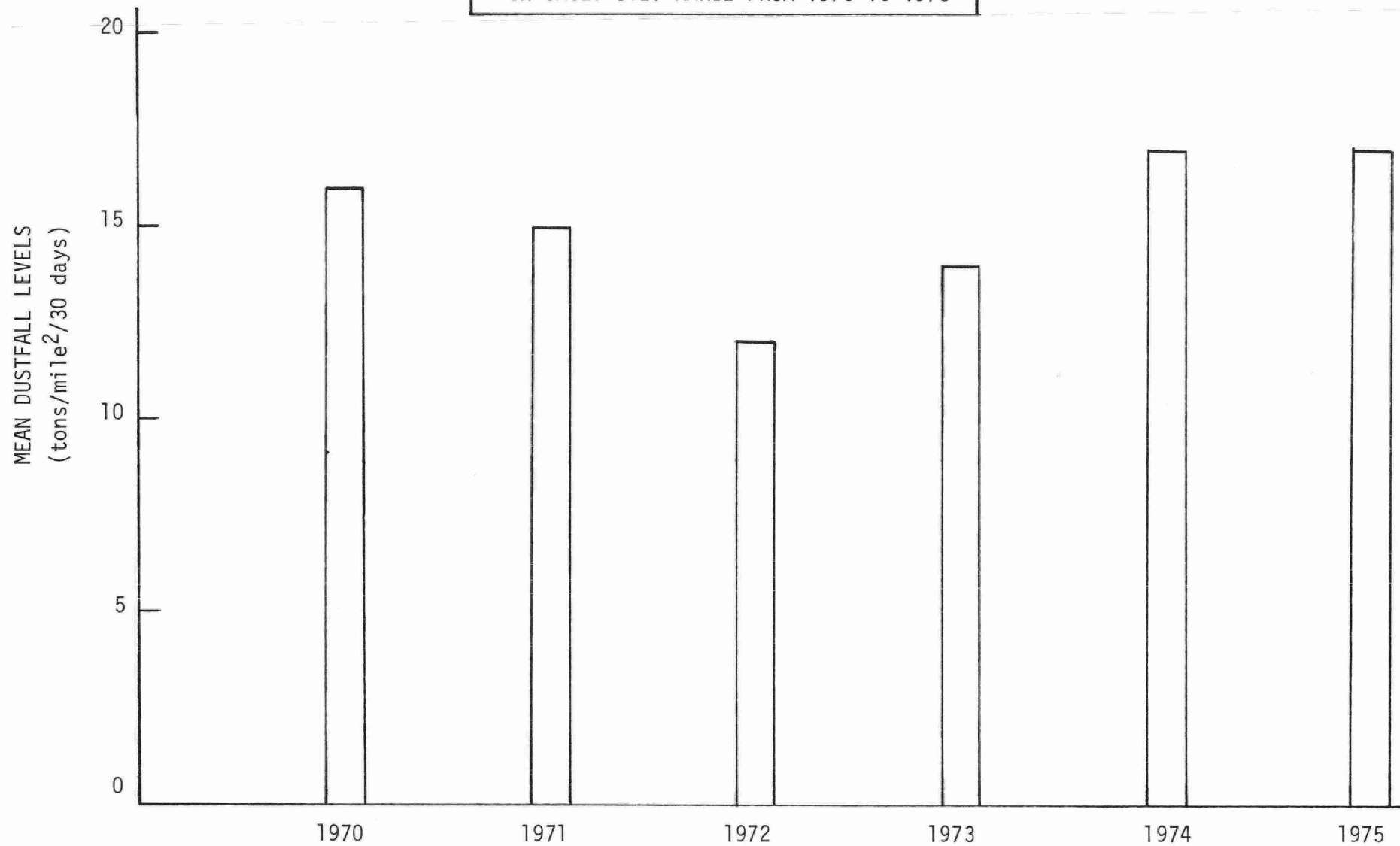


FIGURE 6  
AVERAGE MONTHLY DUSTFALL LEVELS AT STATIONS  
1 AND 2 IN SAULT STE. MARIE FROM 1970 TO 1975

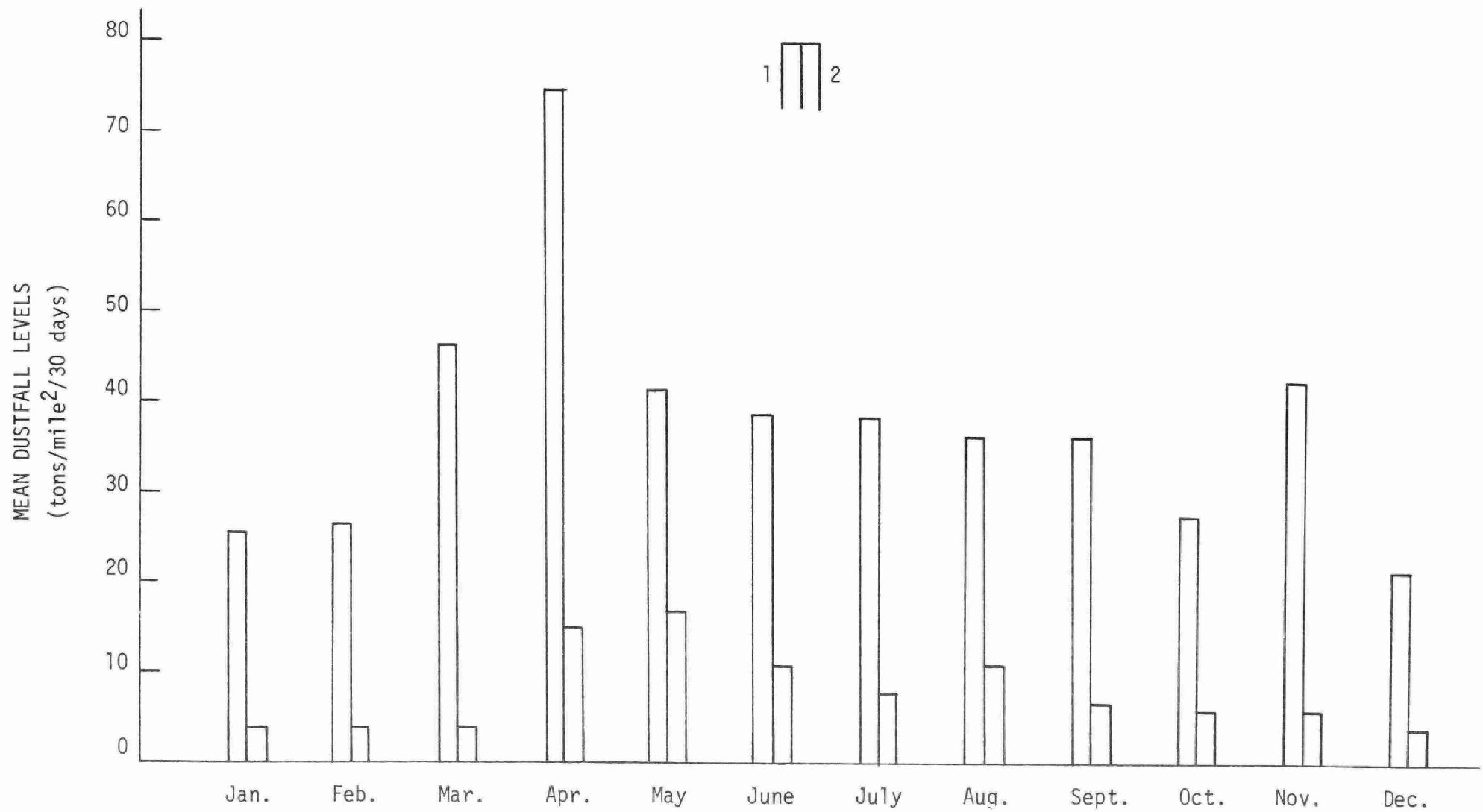




FIGURE 7  
AVERAGE MONTHLY DUSTFALL LEVELS AT STATIONS  
3 AND 4 IN SAULT STE. MARIE FROM 1970 TO 1975

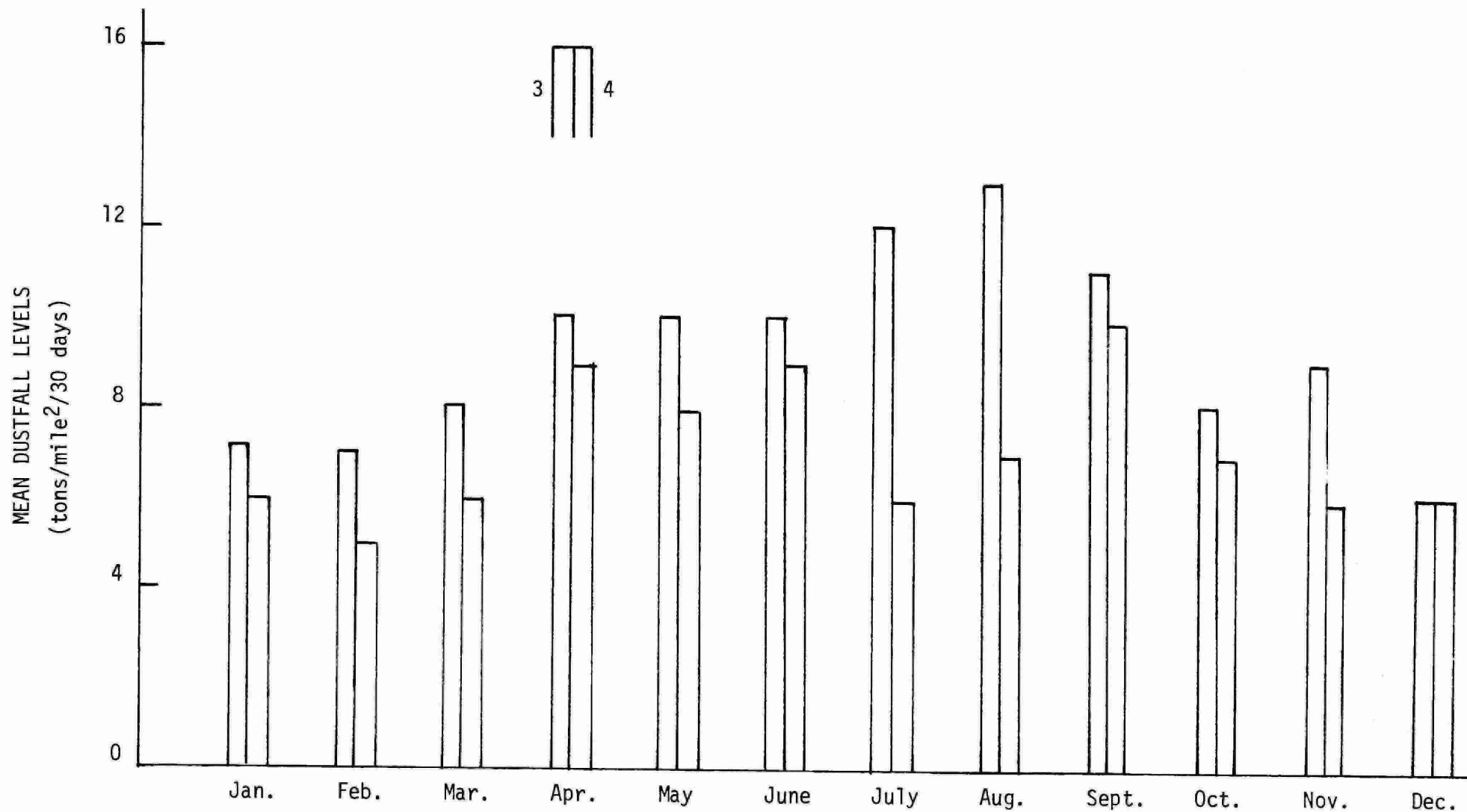


FIGURE 8  
AVERAGE MONTHLY DUSTFALL LEVELS AT STATIONS  
5 AND 6 IN SAULT STE. MARIE FROM 1970 TO 1975

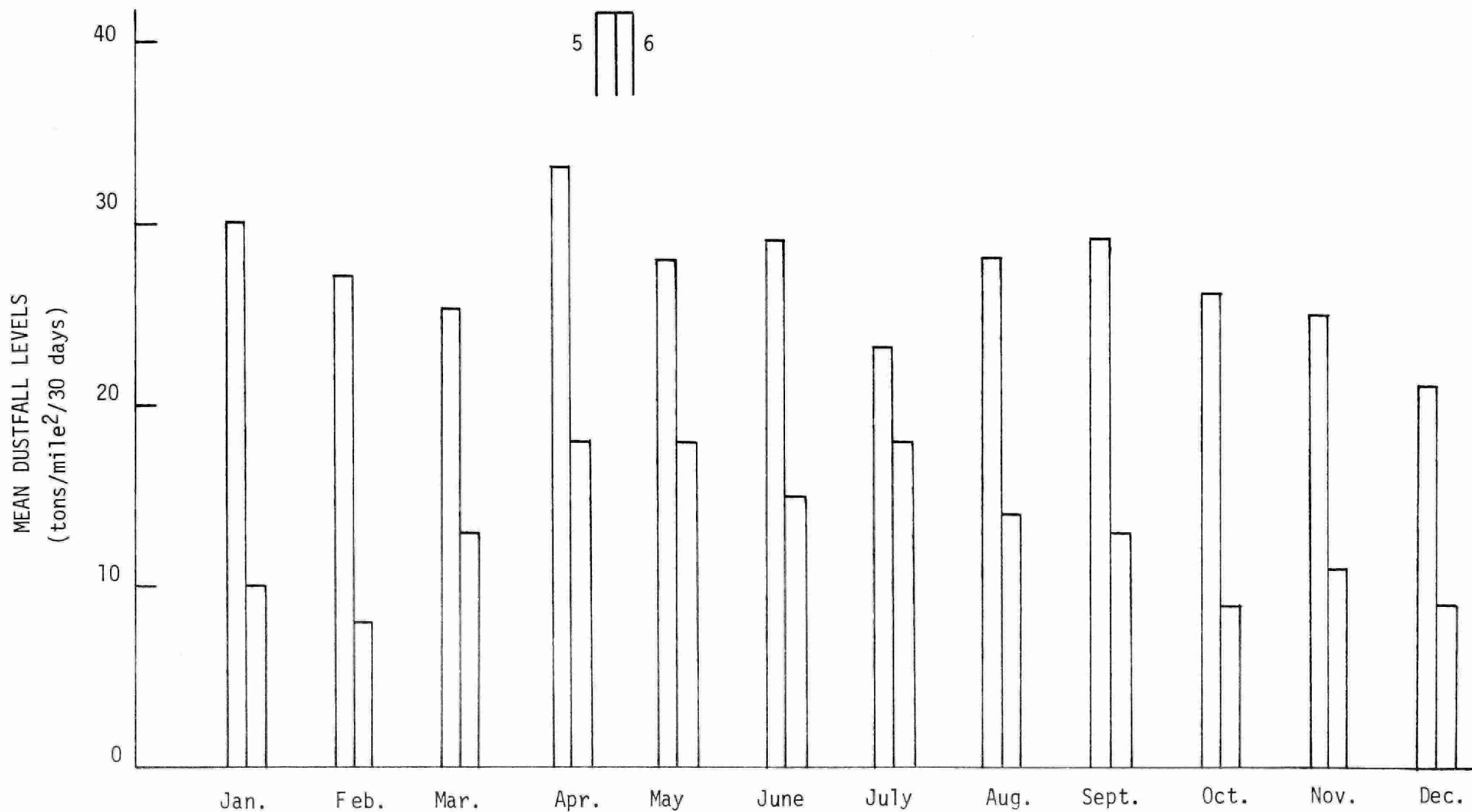


FIGURE 9  
AVERAGE MONTHLY DUSTFALL LEVELS AT STATIONS  
7 AND 8 IN SAULT STE. MARIE FROM 1970 TO 1975

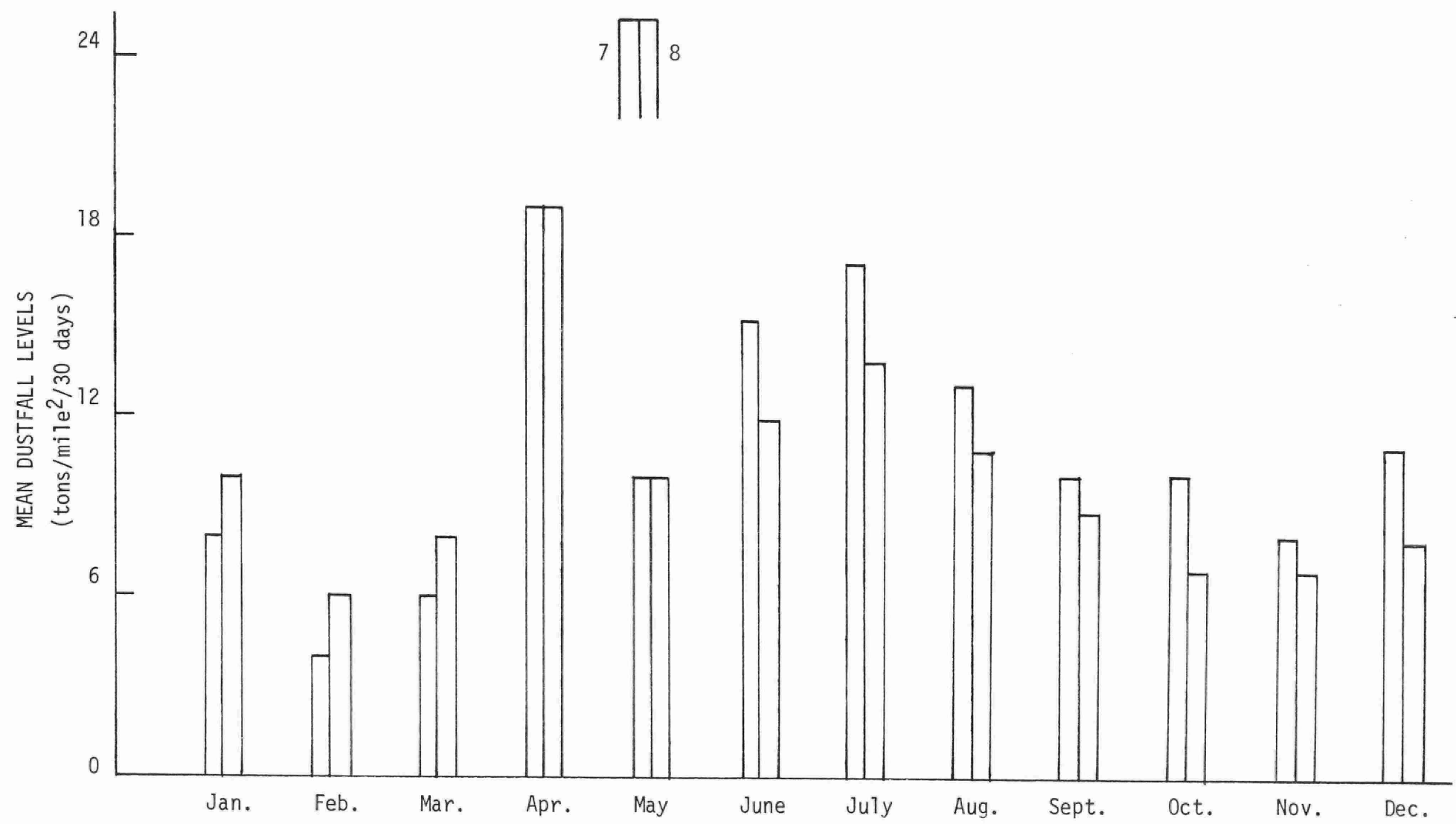


FIGURE 10  
AVERAGE MONTHLY DUSTFALL LEVELS AT STATIONS  
9 AND 10 IN SAULT STE. MARIE FROM 1970 TO 1975

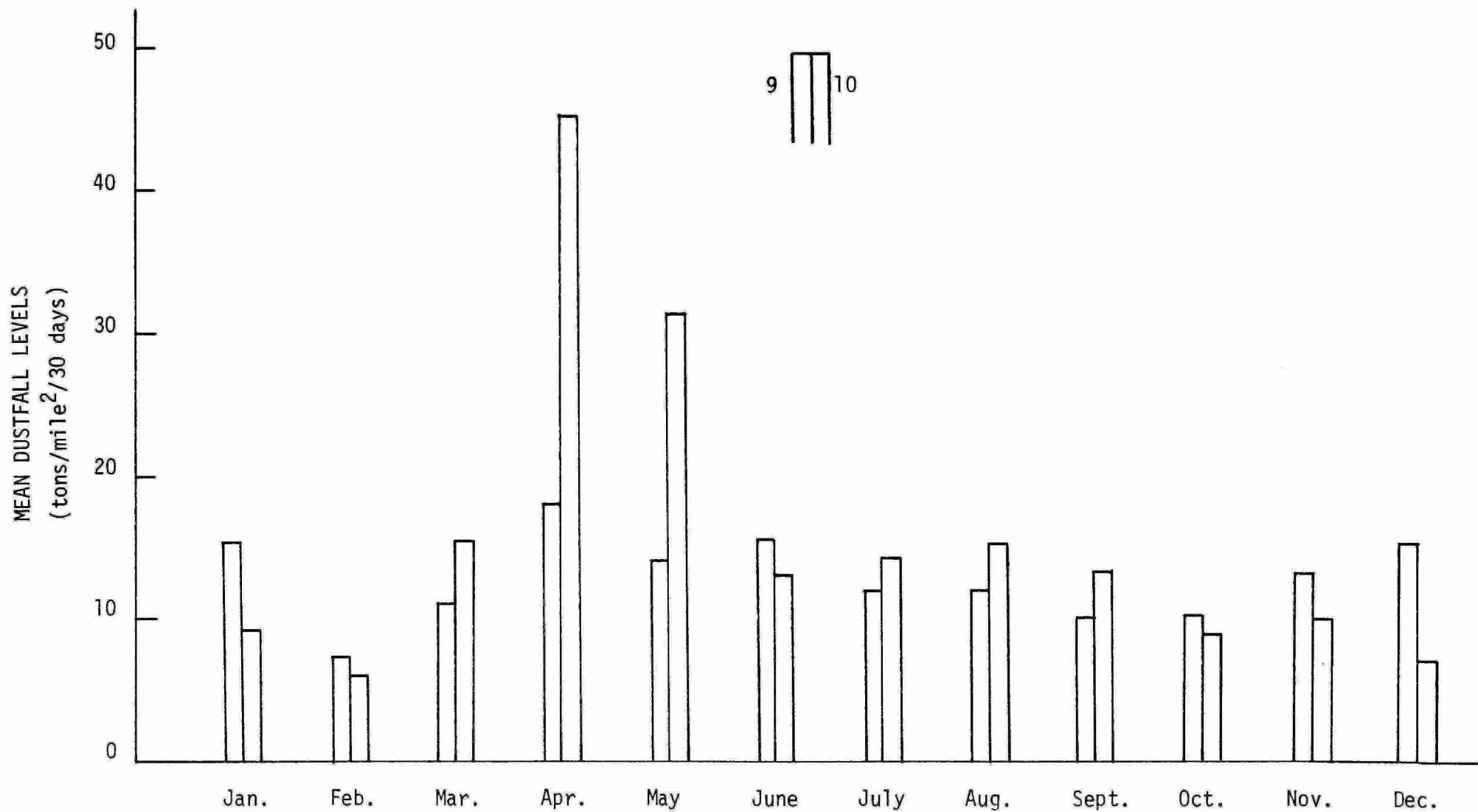


FIGURE 11  
AVERAGE MONTHLY LEVELS OF COEFFICIENT OF HAZE  
AT THE PROVINCE OF ONTARIO BUILDING  
FROM 1970 TO 1975 (2 HR. READINGS)

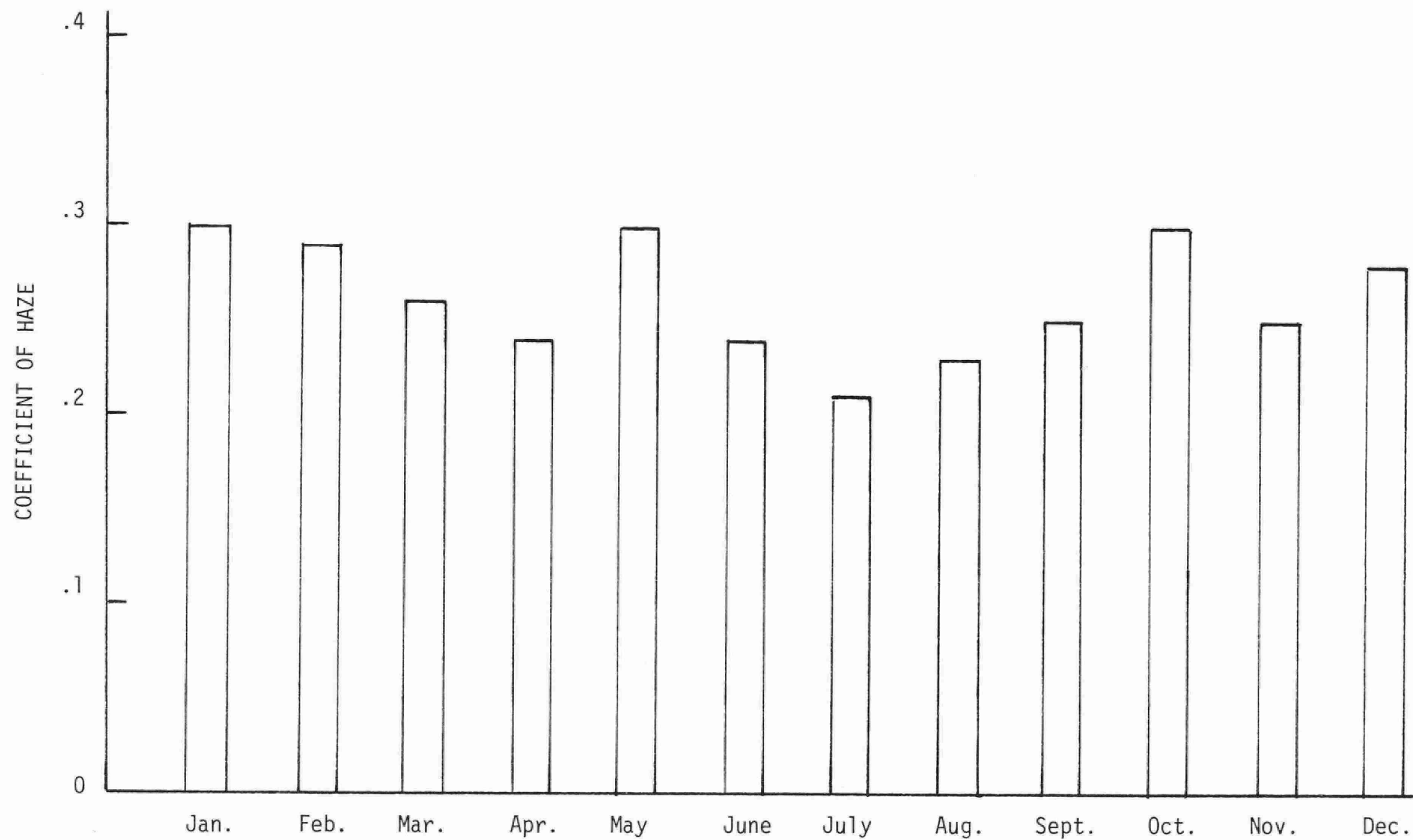


FIGURE 12  
ANNUAL 2-HOURLY AVERAGE LEVELS OF COEFFICIENT OF HAZE  
AT THE PROVINCE OF ONTARIO BUILDING FROM 1970 TO 1975

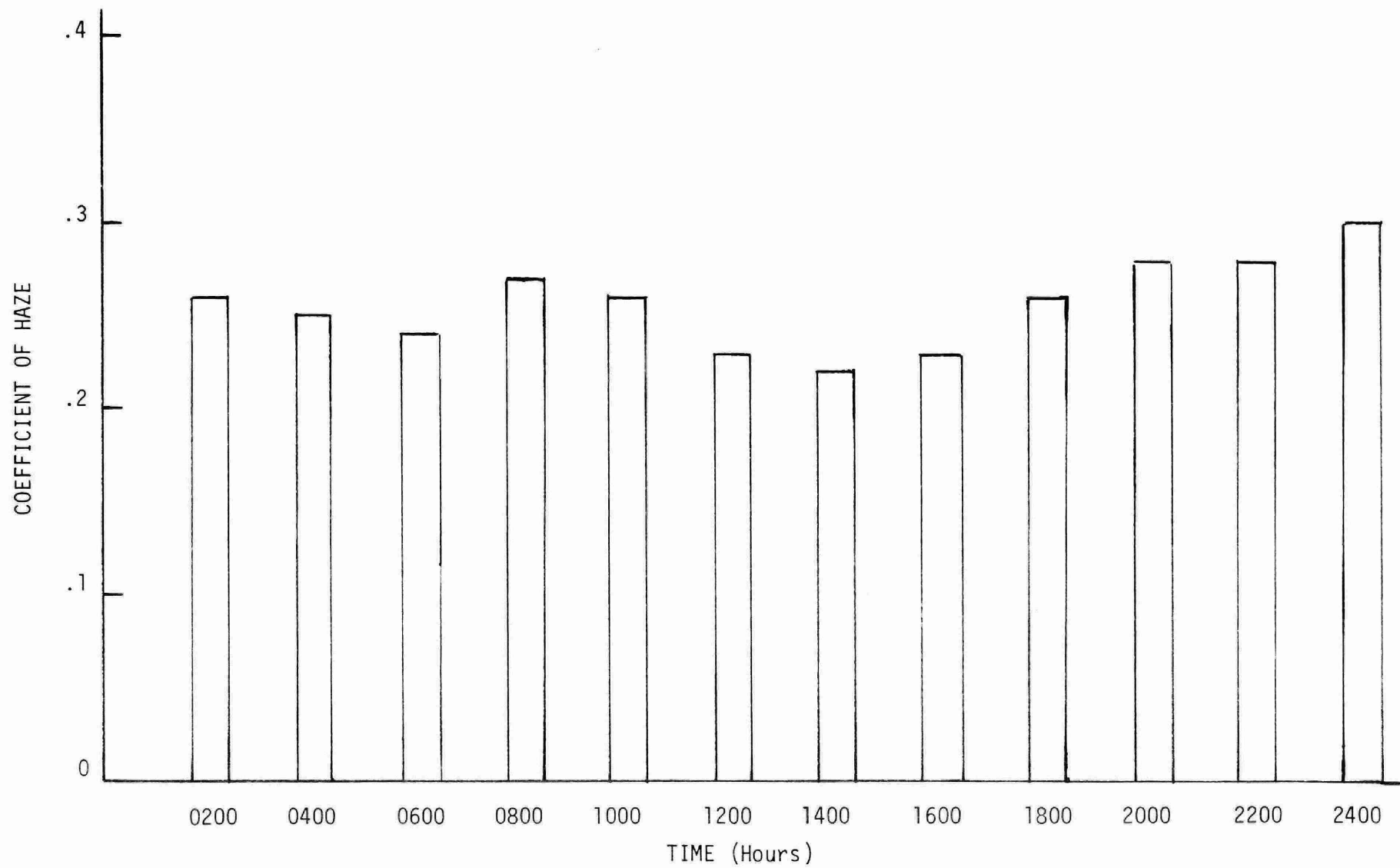


FIGURE 13  
MEAN SULPHATION RATES AT LOCATIONS  
IN SAULT STE. MARIE FROM 1970 TO 1975

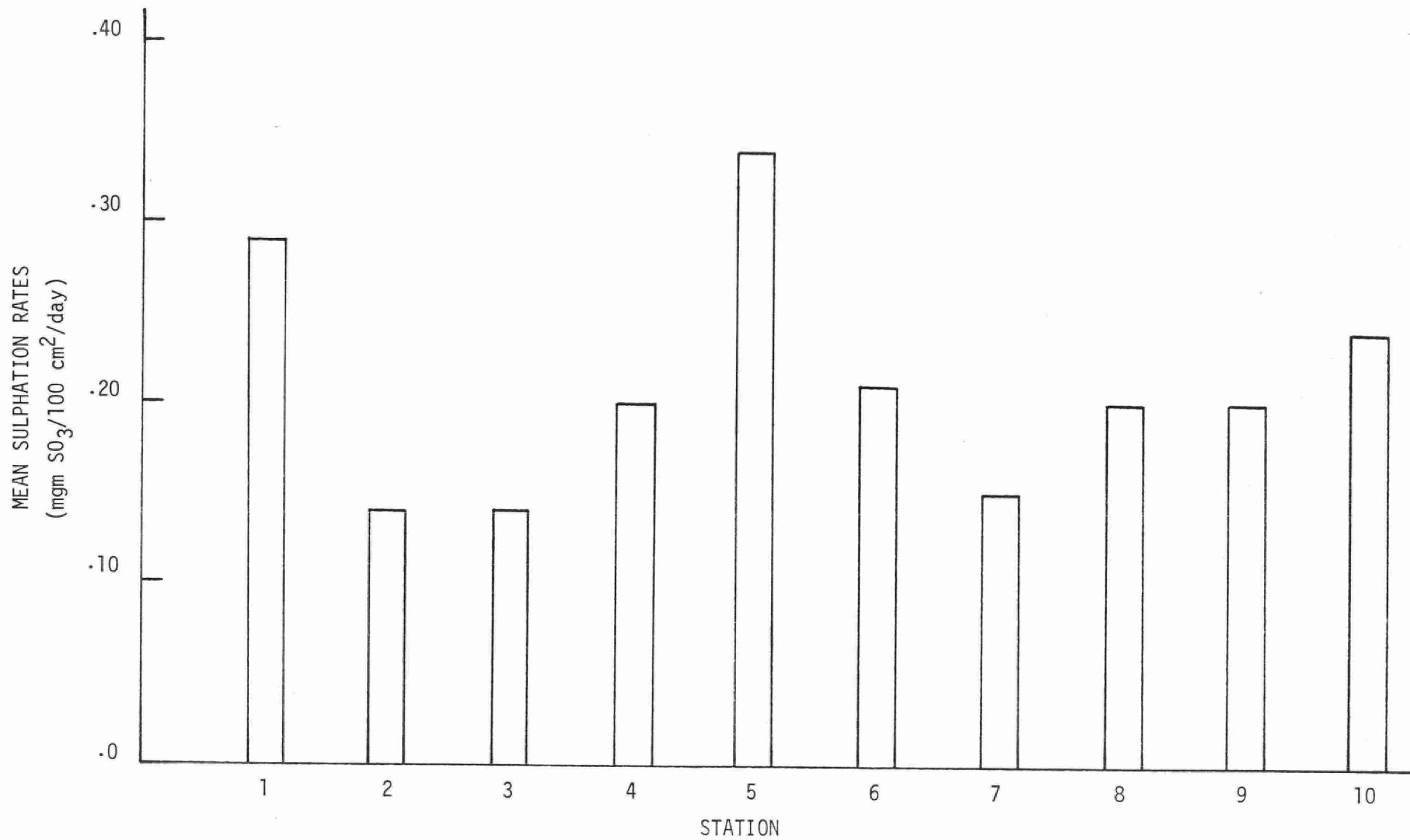


FIGURE 14  
MEAN MONTHLY SULPHATION RATES AT STATIONS  
1 AND 2 IN SAULT STE. MARIE FROM 1970 TO 1975

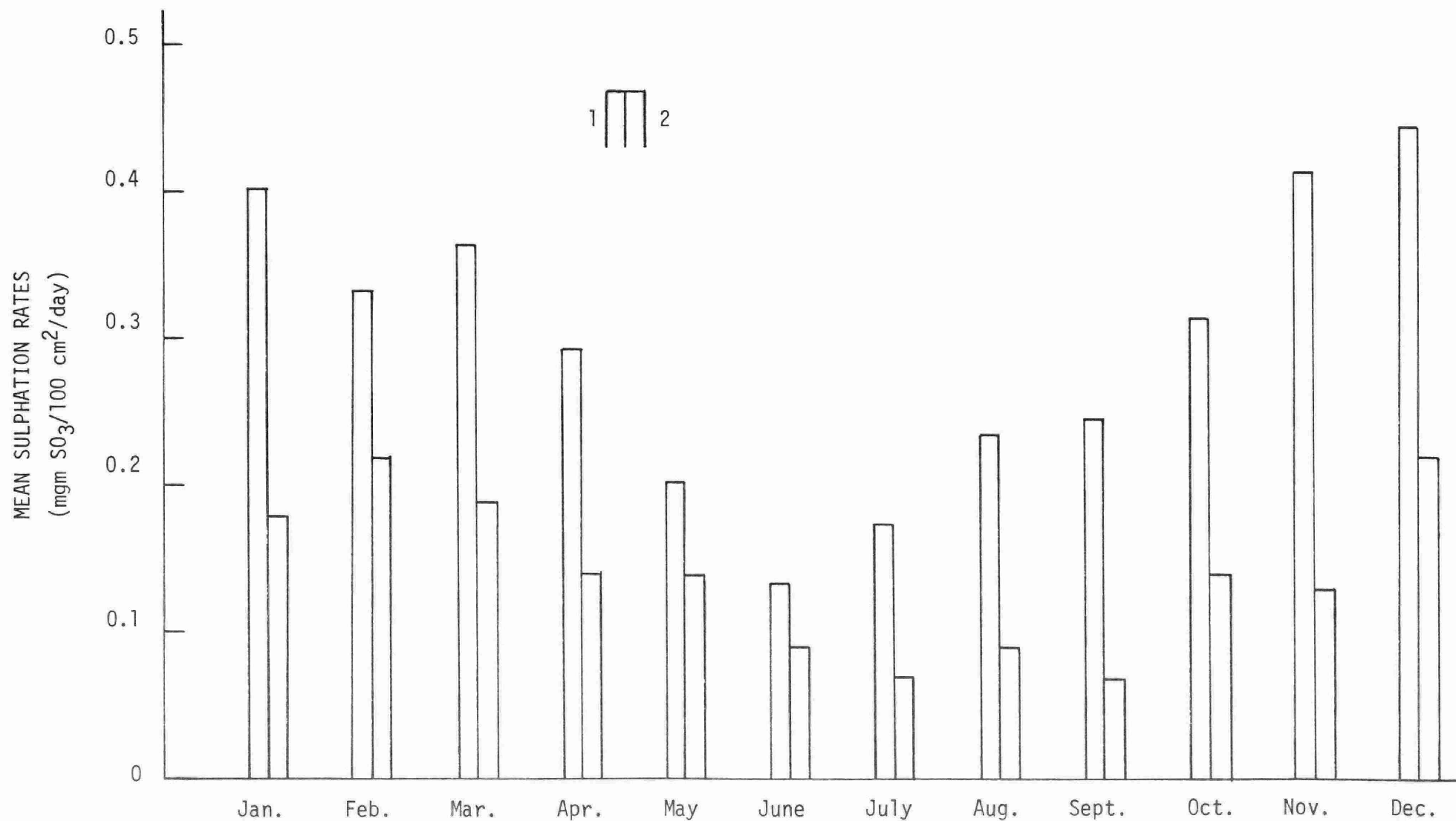




FIGURE 15  
MEAN MONTHLY SULPHATION RATES AT STATIONS  
3 AND 4 IN SAULT STE. MARIE FROM 1970 TO 1975

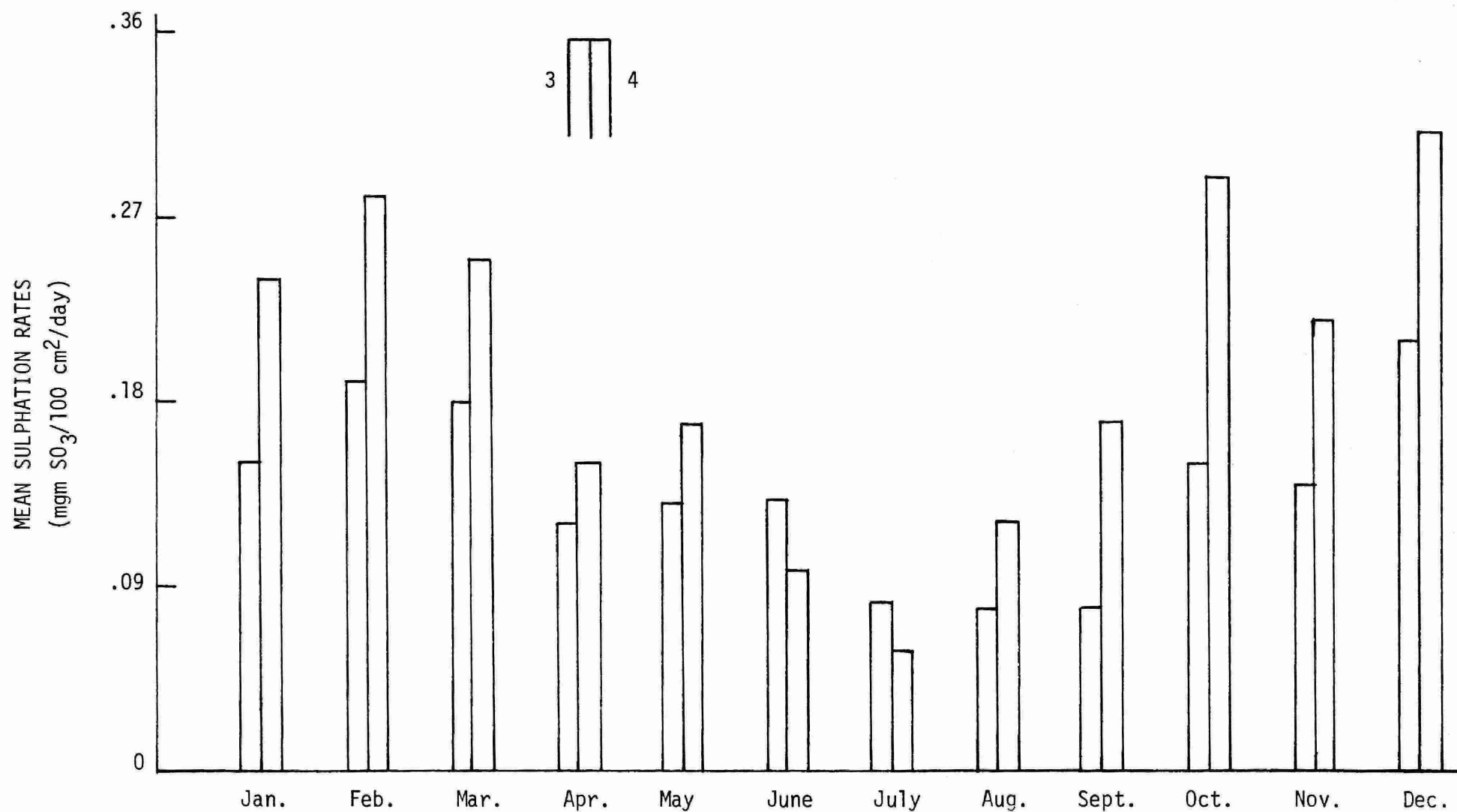


FIGURE 16  
MEAN MONTHLY SULPHATION RATES AT STATIONS  
5 AND 6 IN SAULT STE. MARIE FROM 1970 TO 1975

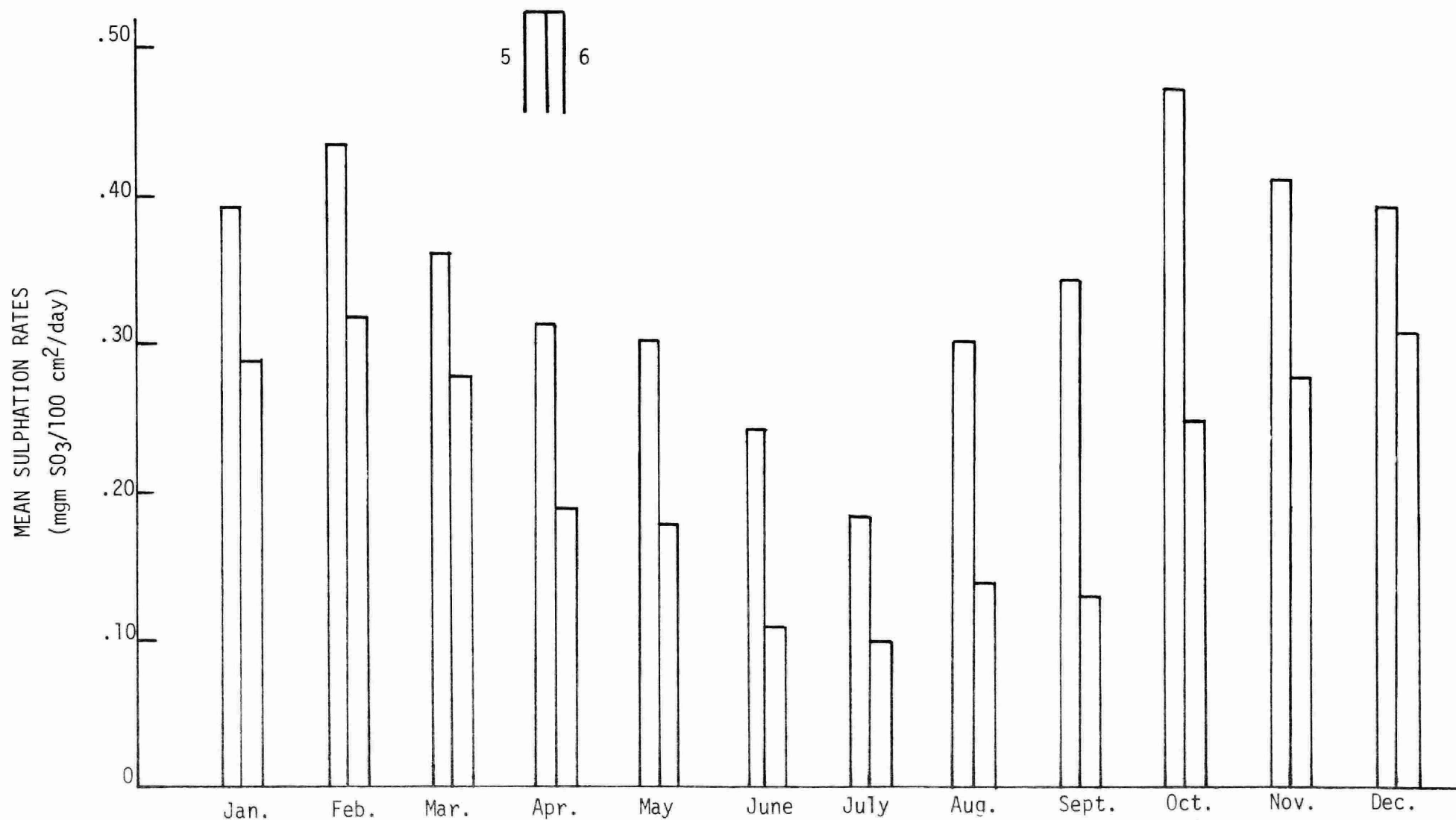


FIGURE 17  
MEAN MONTHLY SULPHATION RATES AT STATIONS  
7 AND 8 IN SAULT STE. MARIE FROM 1970 TO 1975

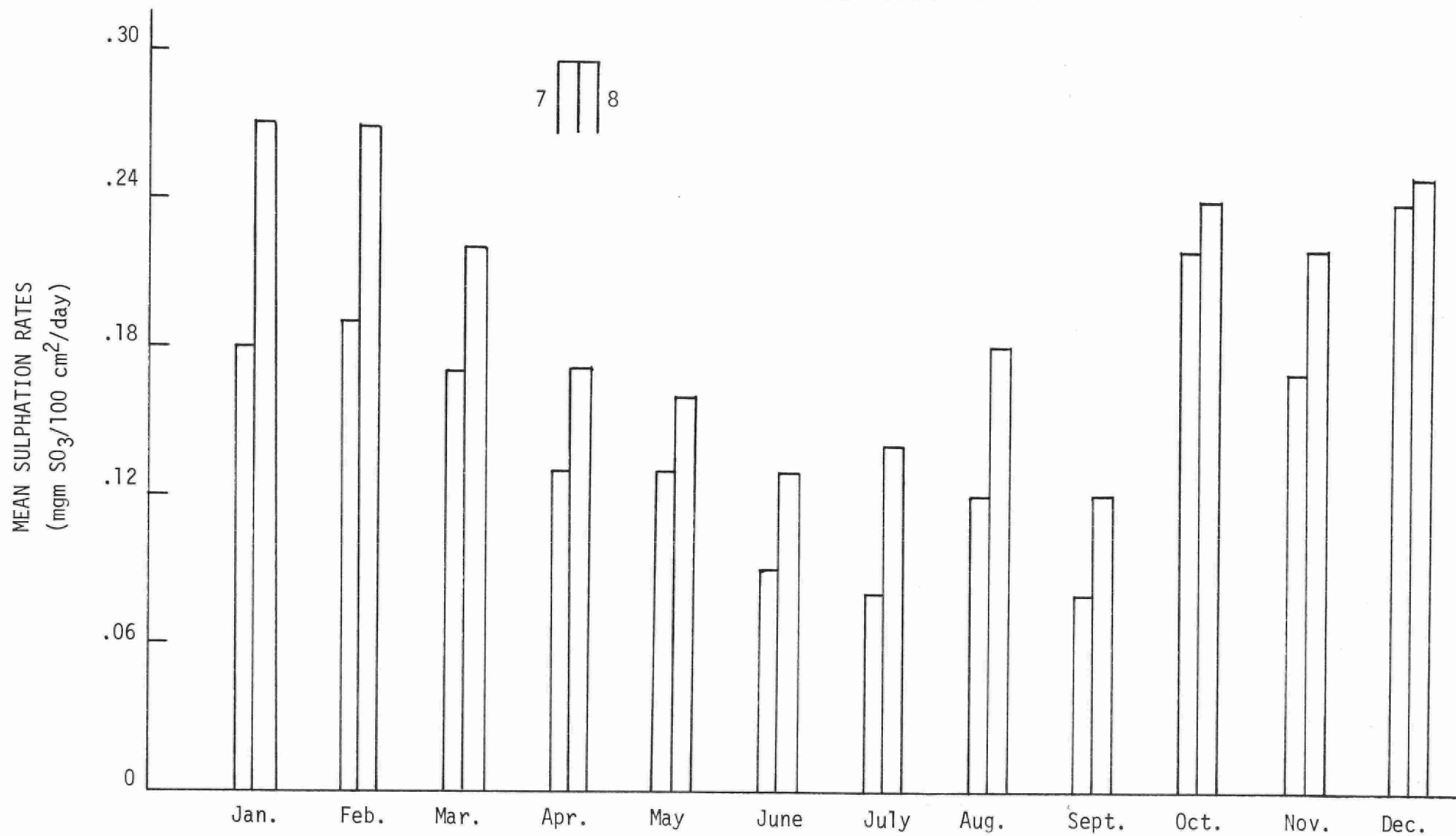


FIGURE 18  
MEAN MONTHLY SULPHATION RATES AT STATIONS  
9 AND 10 IN SAULT STE. MARIE FROM 1970 TO 1975

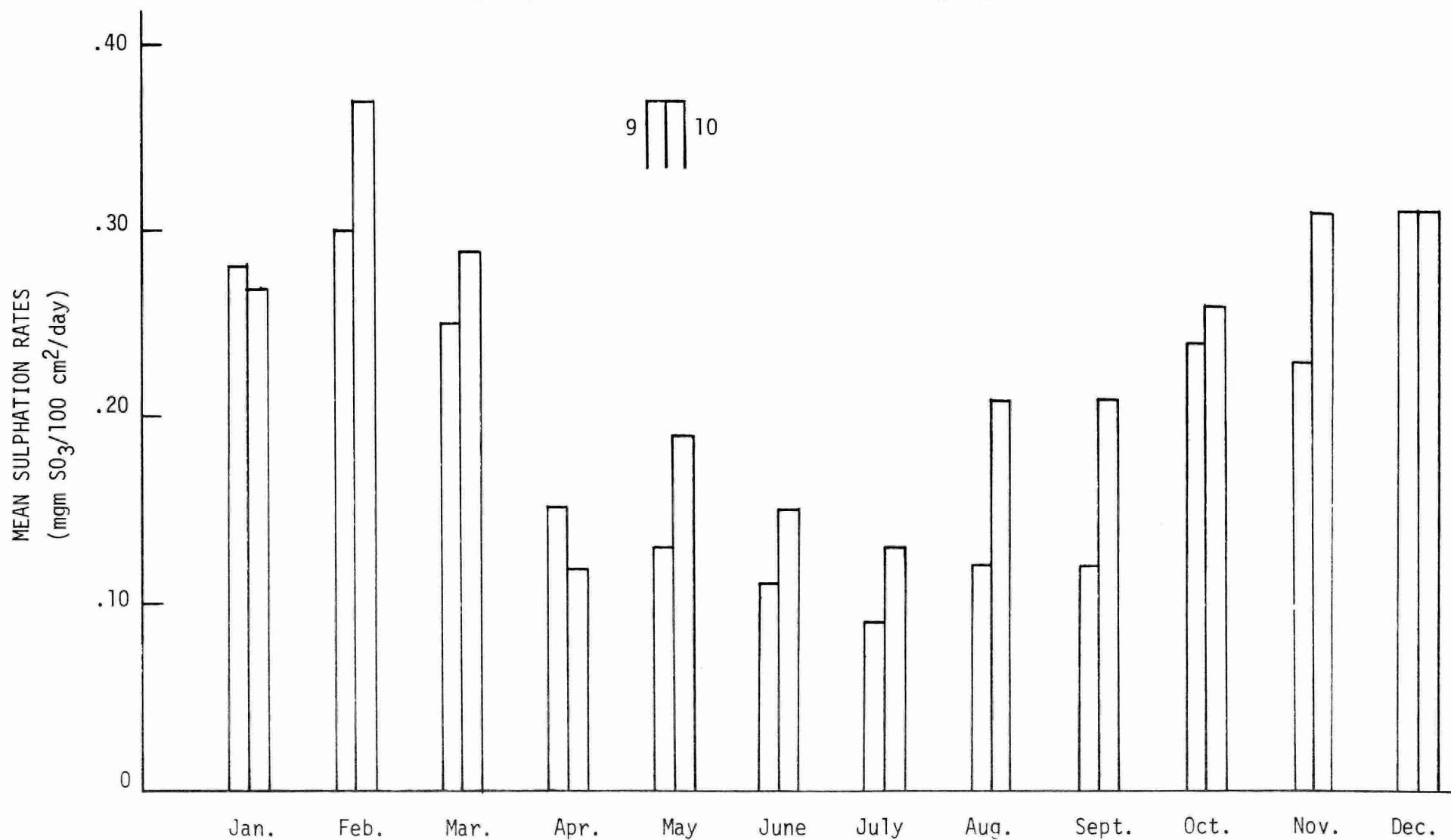


FIGURE 19  
MEAN FLUORIDATION RATES AT LOCATIONS  
IN SAULT STE. MARIE FROM 1971 TO 1975

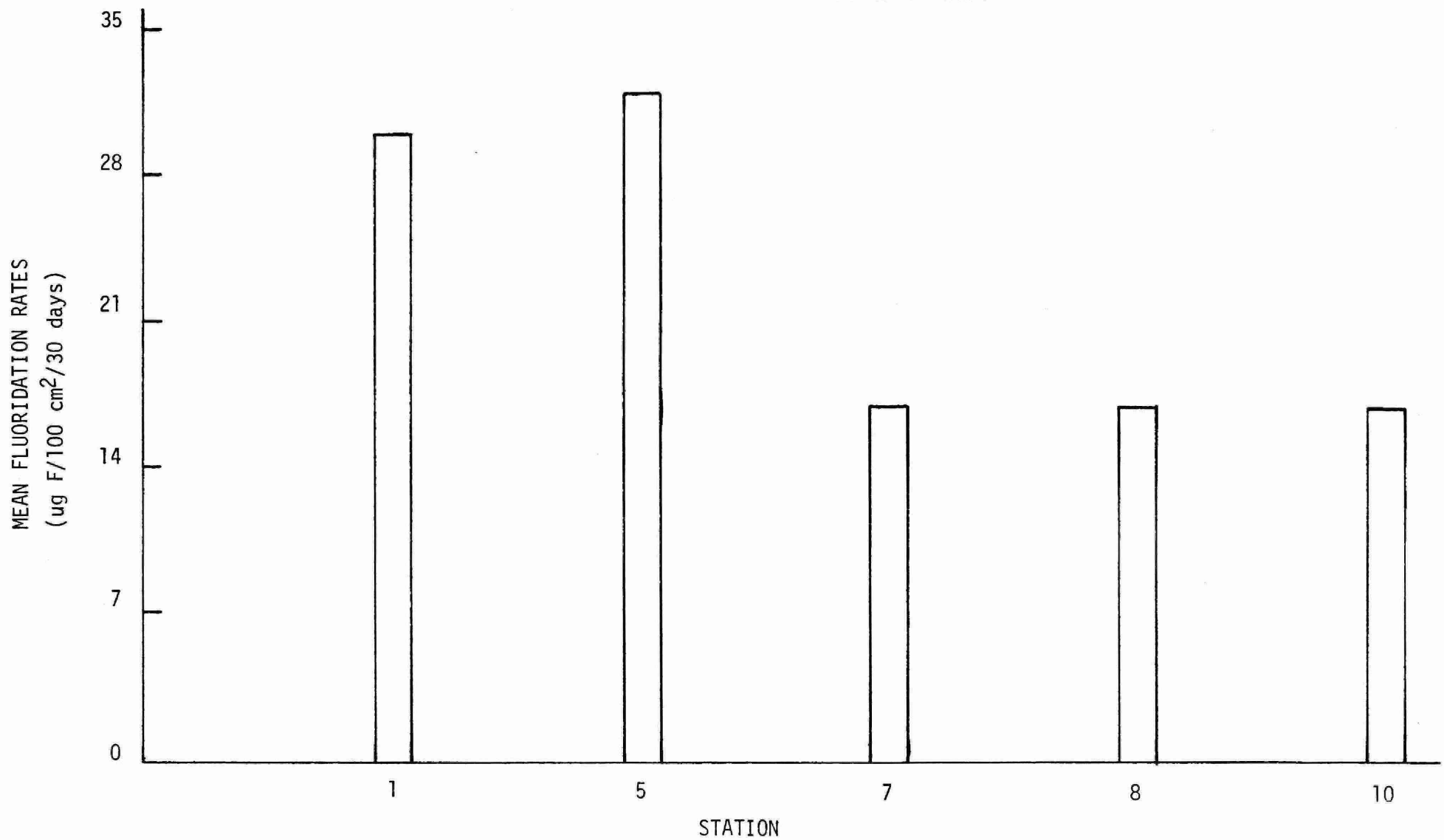


FIGURE 20  
AVERAGE FLUORIDATION RATES AT STATION 1  
IN SAULT STE. MARIE FROM 1971 TO 1975

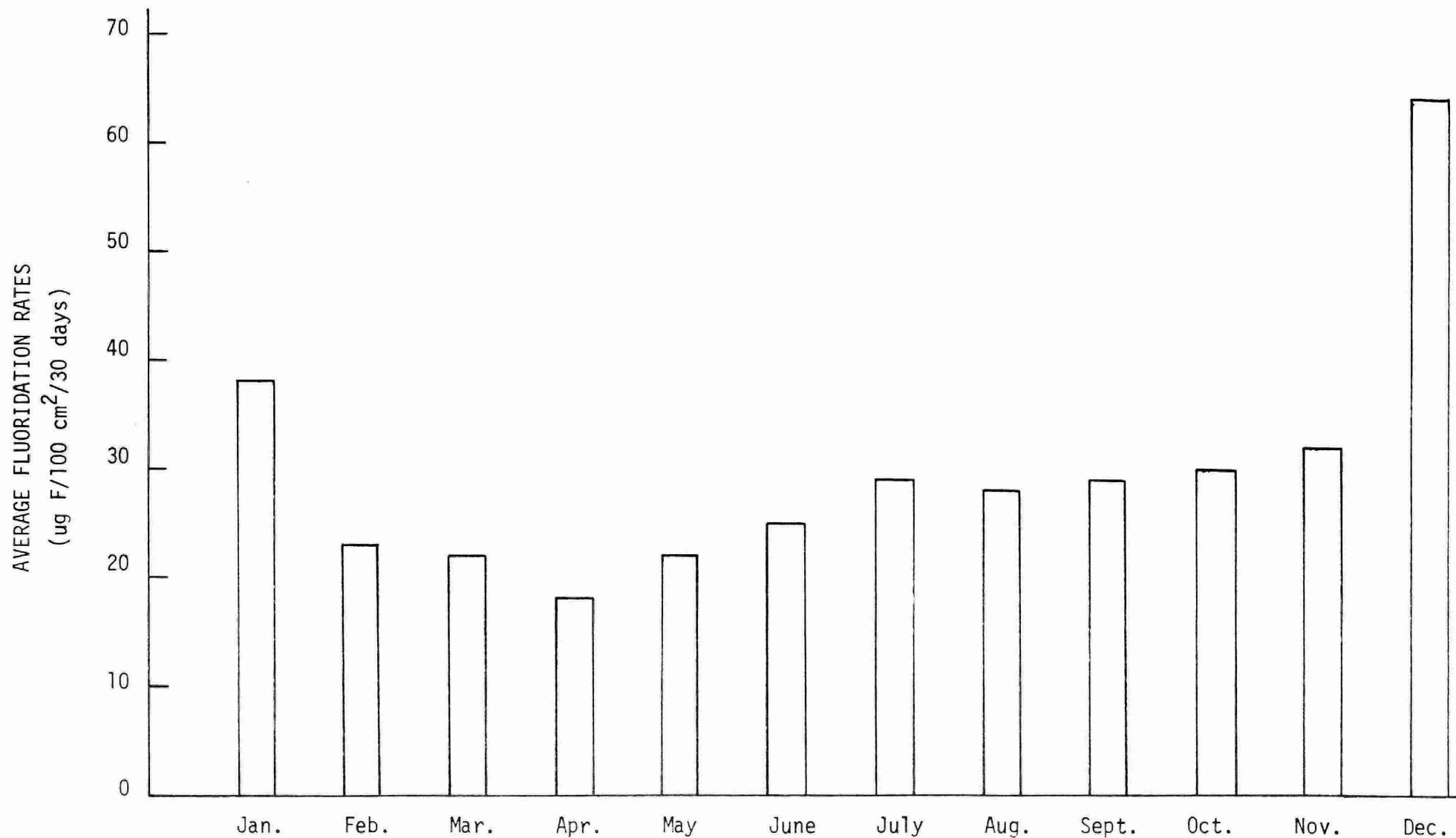


FIGURE 21  
AVERAGE MONTHLY FLUORIDATION RATES AT STATIONS  
5 AND 7 IN SAULT STE. MARIE FROM 1971 TO 1975

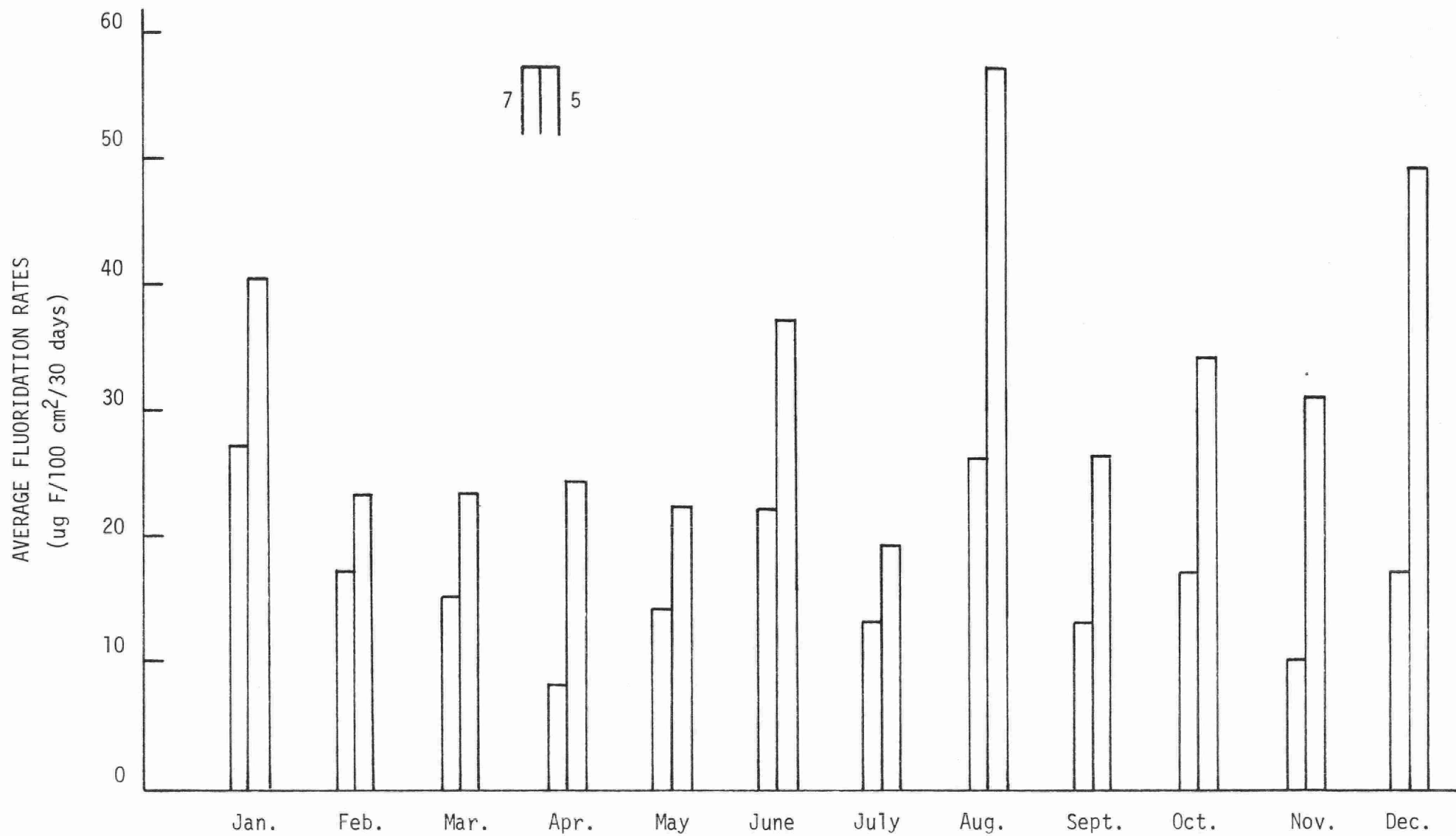


FIGURE 22  
AVERAGE MONTHLY FLUORIDATION RATES AT STATIONS  
8 AND 10 IN SAULT STE. MARIE FROM 1971 TO 1975

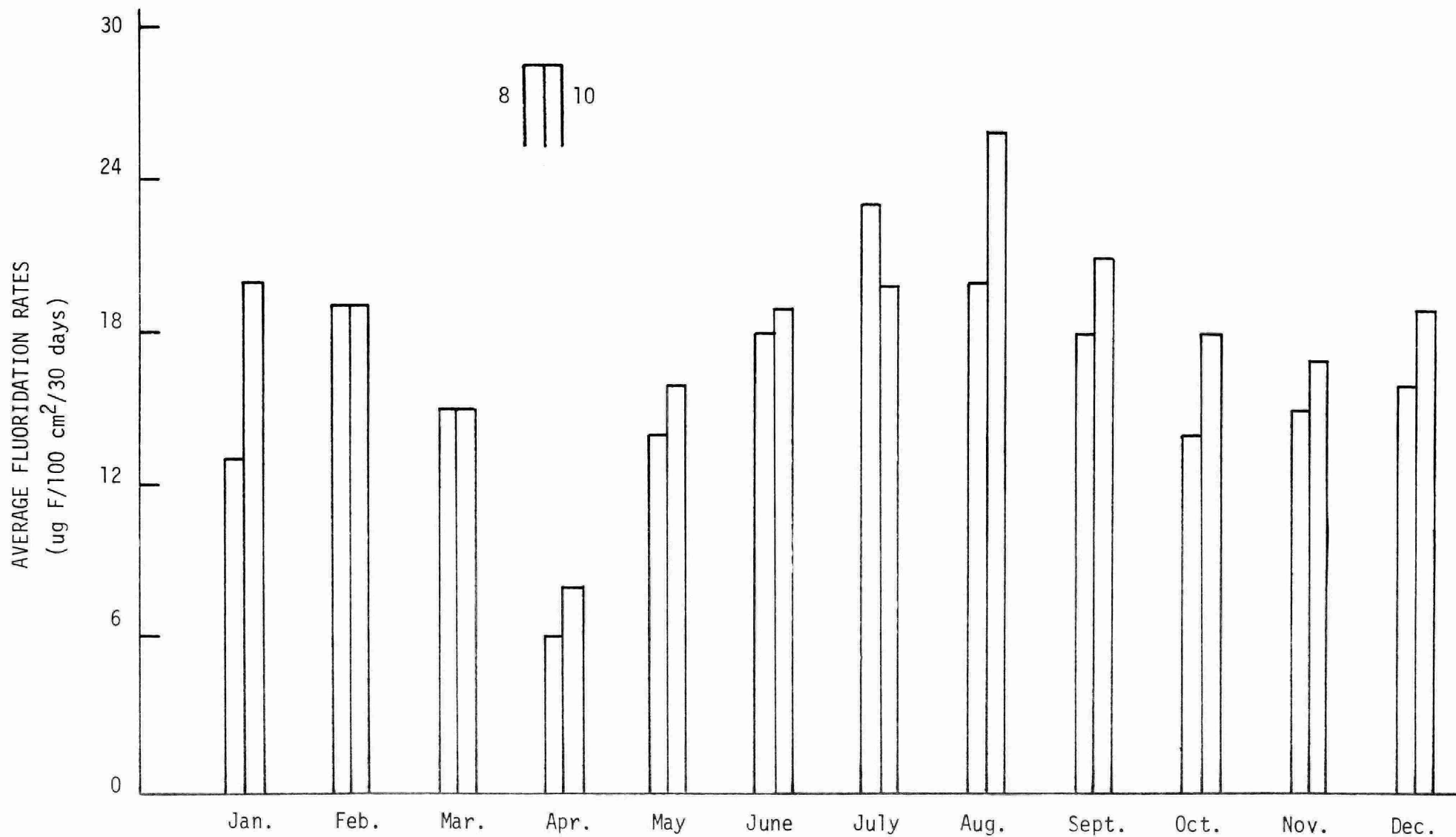




Table 1:

\*CONCENTRATIONS OF VARIOUS CHEMICAL ELEMENTS IN  
FOLIAR SAMPLES OF WHITE BIRCH SAMPLES COLLECTED IN  
SAULT STE. MARIE AND A CONTROL LOCATION DURING 1974

Distance and Direction From Algoma Steel Corporation	Chemical Elements							
	S (%)	As (ppm)	Ca (%)	Cl (%)	Fe (ppm)	Mg (%)	Zn (ppm)	F (ppm)
.5 km West	.26	1.5	1.98	.08	1700	.39	192	14
1.4 km Northwest	.30	2.6	2.01	.06	2120	.39	470	4
1.3 km South*	.33	1.9	1.65	.03	1120	.24	190	8
1.4 km East	.24	1.3	2.23	.12	1330	.30	930	20
2.5 km Northeast	.15	0.7	1.33	.05	670	.43	201	ND
70 km East (Control)	.12	**ND	1.67	.03	510	.35	204	ND

\* Concentrations based on a washed sample.

\*\* Concentrations below detectable level.

Table 2:

CONCENTRATIONS OF VARIOUS CHEMICAL ELEMENTS IN SOIL SAMPLES  
(0-5 cm AND 5-10 cm) COLLECTED IN SAULT STE. MARIE  
AND A CONTROL LOCATION DURING 1974

Distance and Direction From Algoma Steel Corporation	Chemical Elements																	
	S(%)		As(ppm)		Ca(%)		Cl(%)		Fe(%)		Mg(%)		Zn(ppm)		F(ppm)		pH	
	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)	0-5 (cm)	5-10 (cm)
.5 km West	.03	.02	2.8	1.2	.15	.22	ND	ND	.91	1.14	.20	.26	58	40	180	200	6.7	4.1
1.4 km Northwest	.06	.06	20.3	24.3	.21	.18	ND	ND	2.05	1.61	.25	.20	108	98	265	186	7.1	7.1
1.3 km South	.07	.07	9.3	8.5	.16	.28	ND	ND	1.89	1.83	.27	.30	95	68	186	186	6.5	6.4
1.4 km East	.06	.04	3.0	2.4	.21	.21	ND	ND	1.10	1.23	.19	.21	80	65	192	166	6.4	6.3
2.5 km Northeast	.06	.02	4.0	2.8	.60	.75	ND	ND	1.90	1.80	.70	.70	60	55	226	219	7.8	8.0
70 km East (Control)	.02	.03	1.3	1.4	.13	.16	ND	ND	1.18	1.30	.25	.26	35	40	119	113	6.0	6.1

Table 3:

CONCENTRATIONS OF VARIOUS CHEMICAL ELEMENTS  
IN FOLIAR SAMPLES OF WHITE BIRCH COLLECTED  
IN SAULT STE. MARIE AND A CONTROL LOCATION DURING 1975

Distance and Direction From Algoma Steel Corporation	<u>Chemical Elements</u>					
	S (%)	Fe (ppm)	Zn (ppm)	As (ppm)	F (ppm)	Cl (%)
1.3 km South	.34	2783	317	4.3	77	.08
2.5 km Northeast	.12	323	265	.4	3	.05
0.3 km West	.15	793	295	1.2	8	.04
2.8 km Southeast	---	---	---	---	--	---
5.5 km Southeast	.23	680	188	.6	14	.05
160 km East (Control)	.10	210	26	ND	--	.07

Table 4:

CONCENTRATIONS OF VARIOUS CHEMICAL ELEMENTS  
IN SOIL SAMPLES (0-10 cm) COLLECTED IN SAULT STE. MARIE  
AND A CONTROL LOCATION DURING 1975

Distance and Direction From Algoma Steel Corporation	<u>Chemical Elements</u>								
	S (%)	Fe (%)	Zn (ppm)	Cl (%)	As (ppm)	F (ppm)	Ca (ppm)	Mg	pH
1.3 km South	.05	2.8	147	ND	13.3	182	5000	.39	6.1
2.5 km Northeast	.01	1.4	39	ND	1.6	174	5167	.37	5.9
0.3 km West	.07	2.3	112	ND	10.4	226	4417	.42	5.7
2.8 km Southeast	---	1.5	68	ND	2.8	194	3727	.36	5.7
5.5 km Southeast	.02	1.0	33	ND	1.6	118	4290	.24	5.4
160 km East (Control)	.02	1.15	17	ND	1.4	---	1597	10	5.6

Table 5:

CONCENTRATIONS OF VARIOUS CHEMICAL ELEMENTS IN  
SNOW SAMPLES COLLECTED AT SAULT STE. MARIE AND A  
CONTROL LOCATION DURING JANUARY, 1975

Distance and Direction From Algoma Steel Corporation	Chemical Elements							pH
	Fe (ppm)	Zn (ppm)	Na (ppm)	As (ppb)	Cl (ppm)	Ca (ppm)	SO <sub>4</sub> (ppm)	
2.5 km Northeast	0.98	0.03	4.30	ND	6.4	1.3	4	5.0
2.0 km Northwest	1.30	0.03	7.30	8	11.0	1.0	3	5.1
0.5 km West	7.60	0.19	1.10	17	1.6	8.3	7	5.2
1.3 km South	8.60	0.04	0.70	7	0.3	4.7	9	4.9
2.7 km Southeast	0.67	0.06	1.10	ND	1.2	0.5	2	5.3
5.0 km Southeast	0.23	ND*	0.35	ND	0.3	0.2	1	4.8
500 km East (Control)	0.52	.05	0.40	2.2	0.7	0.5	6	4.9

\* Concentrations below detectable level.

Table 6:

CONCENTRATIONS OF VARIOUS CHEMICAL ELEMENTS  
IN SNOW SAMPLES COLLECTED IN SAULT STE. MARIE AND  
A CONTROL LOCATION DURING 1976

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Distance and Direction From Algoma Steel Corporation	<u>Chemical Elements</u>								pH
	As (ppb)	Fe (ppm)	Zn (ppm)	Pb (ppm)	F (ppm)	Na (ppm)	Cl (ppm)	SO <sub>4</sub> (ppm)	
1.0 km North	2	1.4	ND	ND	---	---	----	---	9.0
0.1 km Northeast	8	4.6	.12	.03	.12	.46	3.49	3.5	9.4
0.1 km Northeast	10	7.6	.21	.04	.16	.43	1.64	5.8	9.9
2.0 km Northeast	3	.6	.04	.01	.04	1.30	2.29	1.8	5.2
2.5 km Northeast	3	.8	.06	.02	.05	.66	1.21	2.0	7.6
0.7 km Northwest	8	9.1	.12	.04	.17	1.38	2.80	8.5	9.3 <sup>ds</sup>
1.3 km South	--	4.1	.06	.02	---	---	----	---	7.4
0.3 km Southeast	6	2.0	.14	.02	---	---	----	---	8.1
5.0 km Southeast	1	2.2	.01	.03	.03	.44	.82	2.7	8.4
0.7 km Southwest	--	.3	.05	.02	---	---	----	---	7.5
0.3 km West	--	3.3	.09	---	---	---	----	---	10.2
70 km East (Control)	1	.2	.01	ND	.02	.56	.99	.6	6.4

Table 7

LIST OF THE SITE NUMBERS AND THE STATION LOCATIONS  
FOR THE AMBIENT AIR MONITORING NETWORK  
IN SAULT STE. MARIE DURING 1975

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<u>Site No.</u>	<u>Location</u>	<u>Address</u>
1	Beaver Hotel	569 Queen St. W.
2	Anna McRea Public School	Hugill & Mark Sts.
3	James Lyons Public School	74 John St.
4	Alexander Henry High School	Northern Ave. and Highway 17 N.
5	Bayview Public School	Pittsburgh & Young Sts.
6	Holy Angels Separate School	Wellington St. W.
7	Our Lady of Lourdes Separate School	Prentice & Doncaster Sts.
8	Franklin St. Public School	433 Franklin St.
9	S. F. Howe Public School	Northland & Bloor Sts.
10	Province of Ontario Bldg.	MacDougald & Albert Sts.
11	Land Registry Office	Queen St.
12	Bonney St. Pumphouse	Bonney St.
13	Public Utilities Pole	Wilding St. & Wallace Terrace
14	Public Utilities Pole	Korah Rd. & Wallace Terrace
15	Public Utilities Pole	Adelaide St.
16	Public Utilities Pole	Fairview Ave.
17	Public Utilities Pole	Peoples Road
18	Light Standard	Sault Locks

Table 8

TOTAL DUSTFALL LEVELS AT  
 SITE NO. 1 (BEAVER HOTEL) IN SAULT STE. MARIE FROM 1970 TO 1975  
 (ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	26	37	44	20	30	22	30
1971	22	43	43	62	--	23	67	20	38	22	94	28	42
1972	30	28	36	61	41	32	19	27	40	24	22	15	31
1973	33	20	54	70	36	37	31	30	27	44	46	16	37
1974	22	22	64	108	43	64	32	57	34	36	28	19	44
1975	<u>19</u>	<u>16</u>	<u>32</u>	<u>68</u>	<u>44</u>	<u>32</u>	<u>52</u>	<u>47</u>	<u>32</u>	<u>18</u>	<u>31</u>	<u>23</u>	35
MEAN	25	26	46	74	41	38	38	36	36	27	42	21	37



Table 9

TOTAL DUSTFALL LEVELS AT  
 SITE NO. 2 (ANNA McCREA PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
 (ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	9	19	11	5	2	3	8
1971	5	4	4	10	--	8	13	9	7	3	7	2	7
1972	3	3	2	--	13	4	6	9	7	8	5	3	6
1973	5	5	1	16	19	11	6	6	6	3	6	6	8
1974	4	3	6	14	13	9	4	4	4	7	6	5	7
1975	<u>3</u>	<u>6</u>	<u>6</u>	<u>19</u>	<u>21</u>	<u>21</u>	<u>11</u>	<u>16</u>	<u>9</u>	<u>8</u>	<u>7</u>	<u>3</u>	11
MEAN	4	4	4	15	17	11	8	11	7	6	6	4	8

Table 10

TOTAL DUSTFALL LEVELS AT  
 SITE NO. 3 (JAMES LYONS PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
 (ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	21	19	22	9	11	6	15
1971	8	9	9	11	--	15	13	11	6	12	7	4	10
1972	4	11	--	--	9	5	--	20	10	9	10	4	9
1973	9	4	7	5	9	8	4	8	6	1	8	6	6
1974	7	5	11	12	8	9	3	4	12	7	8	7	8
1975	<u>8</u>	<u>4</u>	<u>5</u>	<u>10</u>	<u>13</u>	<u>15</u>	<u>17</u>	<u>18</u>	<u>9</u>	<u>7</u>	<u>9</u>	<u>6</u>	10
MEAN	7	7	8	10	10	10	12	13	11	8	9	6	9

Table 11

TOTAL DUSTFALL LEVELS AT  
SITE NO. 4 (ALEXANDER HENRY HIGH SCHOOL) IN SAWLT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	10	16	12	6	5	5	9
1971	8	11	11	--	--	12	--	7	13	7	4	9	9
1972	6	4	4	11	8	3	3	6	8	8	7	4	6
1973	5	3	3	2	7	11	4	5	5	1	3	10	5
1974	6	2	7	12	6	4	4	3	11	10	9	5	7
1975	<u>7</u>	<u>3</u>	<u>3</u>	<u>9</u>	<u>11</u>	<u>15</u>	<u>10</u>	<u>--</u>	<u>--</u>	<u>11</u>	<u>9</u>	<u>5</u>	8
MEAN	6	5	6	9	8	9	6	7	10	7	6	6	7

Table 12

TOTAL DUSTFALL LEVELS AT  
SITE NO. 5 (BAYVIEW PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	44	32	36	33	33	--	36
1971	32	19	19	27	--	19	19	24	27	23	9	14	21
1972	12	15	11	28	27	13	19	19	26	23	13	15	18
1973	18	24	17	30	23	29	17	32	25	11	28	21	23
1974	27	32	44	38	25	30	5	23	26	31	31	32	29
1975	<u>63</u>	<u>44</u>	<u>36</u>	<u>41</u>	<u>38</u>	<u>55</u>	<u>32</u>	<u>35</u>	<u>33</u>	<u>34</u>	<u>33</u>	<u>22</u>	39
MEAN	30	27	25	33	28	29	23	28	29	26	25	21	27

Table 13

TOTAL DUSTFALL LEVELS AT  
SITE NO. 6 (HOLY ANGELS SEPARATE SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	10	--	14	10	6	11	10
1971	10	9	9	10	--	12	17	21	11	6	8	8	11
1972	5	7	7	13	14	6	--	10	17	8	10	5	9
1973	12	5	15	20	15	14	12	8	12	7	7	7	11
1974	10	7	28	24	19	15	35	11	8	14	17	15	17
1975	<u>11</u>	<u>14</u>	<u>7</u>	<u>24</u>	<u>24</u>	<u>27</u>	<u>15</u>	<u>19</u>	<u>13</u>	<u>6</u>	<u>15</u>	<u>5</u>	15
MEAN	10	8	13	18	18	15	18	14	13	9	11	9	13

Table 14

TOTAL DUSTFALL LEVELS AT  
SITE NO. 7 (LADY OF LOURDES SEPARATE SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	--	13	10	12	12	9	11
1971	6	4	4	12	--	--	31	15	13	9	7	14	12
1972	6	3	5	17	11	3	--	--	11	11	9	7	8
1973	12	6	9	18	7	24	--	11	9	8	4	7	10
1974	7	5	10	36	9	18	7	10	6	8	8	18	12
1975	<u>8</u>	<u>4</u>	<u>3</u>	<u>11</u>	<u>12</u>	<u>14</u>	<u>13</u>	<u>15</u>	<u>10</u>	<u>10</u>	<u>10</u>	<u>8</u>	10
MEAN	8	4	6	19	10	15	17	13	10	10	8	11	10

Table 15

TOTAL DUSTFALL LEVELS AT  
SITE NO. 8 (FRANKLIN STREET PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	21	14	10	7	4	5	10
1971	10	10	10	9	--	8	14	11	8	8	6	5	9
1972	11	6	6	18	7	5	7	8	6	8	8	6	8
1973	10	4	8	9	10	13	9	9	6	3	8	5	8
1974	10	4	13	48	7	15	17	7	10	8	10	15	14
1975	<u>9</u>	<u>5</u>	<u>4</u>	<u>12</u>	<u>16</u>	<u>18</u>	<u>14</u>	<u>15</u>	<u>12</u>	<u>10</u>	<u>--</u>	<u>9</u>	11
MEAN	10	6	8	19	10	12	14	11	9	7	7	8	10

Table 16

TOTAL DUSTFALL LEVELS AT  
SITE NO. 9 (S. F. HOWE PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	20	--	9	9	11	14	13
1971	14	12	12	6	--	21	17	13	8	13	8	10	12
1972	13	6	--	17	12	10	8	12	10	9	16	10	11
1973	13	6	9	7	10	9	10	--	9	4	11	12	9
1974	14	5	16	46	11	19	4	9	13	12	19	29	16
1975	<u>19</u>	<u>7</u>	<u>8</u>	<u>14</u>	<u>21</u>	<u>18</u>	<u>14</u>	<u>14</u>	<u>10</u>	<u>12</u>	<u>--</u>	<u>--</u>	14
MEAN	15	7	11	18	14	15	12	12	10	10	13	15	13



Table 17

TOTAL DUSTFALL LEVELS AT  
SITE NO. 10 (PROVINCE OF ONTARIO BUILDING) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	20	15	16	9	8	3	12
1971	8	--	--	12	--	19	21	28	10	7	7	5	13
1972	9	7	12	28	13	8	8	12	14	13	9	5	12
1973	12	6	19	100	80	6	12	11	8	4	11	5	23
1974	7	6	20	60	16	8	3	8	15	12	13	19	16
1975	<u>8</u>	<u>6</u>	<u>10</u>	<u>25</u>	<u>15</u>	<u>22</u>	<u>18</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	15
MEAN	9	6	15	45	31	13	14	15	13	9	10	7	15

Table 18

TOTAL DUSTFALL LEVELS AT  
SITE NO. 11 (LAND REGISTRY OFFICE) IN SAULT STE. MARIE FOR 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1975	--	--	--	--	--	--	--	31	22	--	10	5	17

Table 19

TOTAL DUSTFALL LEVELS AT NEW LOCATIONS  
IN SAULT STE. MARIE DURING 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Site No.</u>	<u>Location</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
12	Bonney St.	--	--	--	--	--	--	55	43	59	36	52	38	47
13	Wilding St. and Wallace Terrace	--	--	--	--	--	--	32	25	23	3	--	15	20
14	Korah Rd. and Wallace Terrace	--	--	--	--	--	--	47	27	23	18	18	12	24
15	Adelaide St.	--	--	--	--	--	--	38	19	18	15	13	--	21
16	Fairview Ave.	--	--	--	--	--	--	28	25	21	16	12	10	19
17	Peoples Rd.	--	--	--	--	--	--	17	18	--	14	18	9	15
18	Sault Locks	--	--	--	--	--	--	38	26	18	7	7	6	17

Table 20

ANNUAL MEAN DUSTFALL LEVELS AND THE NUMBER OF  
TIMES ABOVE THE MONTHLY CRITERION FOR  
LOCATIONS IN SAULT STE. MARIE FROM 1970 TO 1975

Site No.	Annual Mean Dustfall Levels (tons/mile <sup>2</sup> /30 days)*						No. of Times Above Criterion (30 Days) **						Total	
	1970	1971	1972	1973	1974	1975	1970	1971	1972	1973	1974	1975		
1	36 <sup>6</sup>	42 <sup>11</sup>	31	37	44	35	5	10	10	10	11	9	55	
2	8 <sup>6</sup>	7 <sup>11</sup>	6 <sup>11</sup>	8	7	11	NIL	NIL	NIL	NIL	NIL	2	2	
3	15 <sup>6</sup>	10 <sup>11</sup>	9 <sup>9</sup>	6	8	10	2	NIL	NIL	NIL	NIL	NIL	2	
4	9 <sup>6</sup>	9 <sup>9</sup>	6	5	7	8 <sup>10</sup>	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
5	36 <sup>5</sup>	21 <sup>11</sup>	18	23	29	39	5	5	4	8	11	12	45	
6	10 <sup>5</sup>	11 <sup>11</sup>	9 <sup>11</sup>	11	17	15	NIL	1	NIL	NIL	3	3	7	
7	11 <sup>5</sup>	12 <sup>10</sup>	8 <sup>10</sup>	10 <sup>11</sup>	12	10	NIL	1	NIL	1	1	NIL	3	
8	10 <sup>6</sup>	9 <sup>11</sup>	8	8	14	11 <sup>11</sup>	1	NIL	NIL	NIL	1	NIL	2	
9	13 <sup>5</sup>	12 <sup>11</sup>	11 <sup>11</sup>	9 <sup>11</sup>	16	14 <sup>10</sup>	NIL	1	NIL	NIL	2	1	4	
10	12 <sup>6</sup>	13 <sup>9</sup>	12	23	16	15 <sup>7</sup>	NIL	2	1	2	NIL	2	7	
MEAN	16	15	12	14	17	17	TOTAL	13	20	15	21	29	29	127

Ontario Criterion: \* 1 year: 13 tons/mile<sup>2</sup>/30 days

\*\* 30 days: 20 tons/mile<sup>2</sup>/30 days

Table 21

MEAN DUSTFALL LEVELS AND THE NUMBER OF  
TIMES ABOVE THE MONTHLY CRITERION FOR NEW LOCATIONS  
IN SAULT STE. MARIE FOR JULY TO DECEMBER 1975

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<u>Site No.</u>	<u>Mean Dustfall Levels (tons/mile<sup>2</sup>/30 days)</u>	<u>No. of Times Above Criterion (30 Days)</u>
11	17 <sup>4</sup>	2
12	47	6
13	20	3
14	24	3
15	21 <sup>5</sup>	1
16	19	2
17	15 <sup>5</sup>	NIL
18	17	2
		<hr/> 19

Ontario Criterion:

\* 1 year: 13 tons/mile<sup>2</sup>/30 days

\*\* 30 days: 20 tons/mile<sup>2</sup>/30 days

Table 22

ELEMENTAL ANALYSIS OF DUSTFALL  
AT 4 LOCATIONS IN SAULT STE. MARIE  
FOR AUGUST AND OCTOBER 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Location</u>	<u>Month</u>	<u>Cu</u>	<u>Elements</u>		<u>Zn</u>
			<u>Fe</u>	<u>Ni</u>	
Beaver Hotel	August	.009	11.7	.005	.06
	October	.005	2.2	.005	.03
Bayview Public School	August	.007	1.7	.003	.04
	October	.007	1.8	.007	.04
Holy Angels Separate School	August	.008	0.55	.004	.02
	October	.009	0.35	.003	.01
S. F. Howe Public School	August	.007	0.85	.003	.02
	October	.005	0.72	.004	.02

Table 23

ELEMENTAL ANALYSIS OF DUSTFALL  
AT SITE NO. 11 (LAND REGISTRY OFFICE) IN  
SAULT STE. MARIE FOR SEPTEMBER AND DECEMBER 1975  
(ALL VALUES IN TONS/MILE<sup>2</sup>/30 DAYS)

<u>Month</u>	<u>As</u>	<u>Cd</u>	<u>Cu</u>	<u>Elements</u>		<u>Ni</u>	<u>Zn</u>
				<u>Fe</u>	<u>Pb</u>		
September	0.0	0.0	.01	0.61	.09	.004	.03
December	0.0	0.0	.004	0.08	.35	.003	.01

Table 24

SUMMARY OF THE LEVELS OF TOTAL SUSPENDED PARTICULATES  
AND THE NUMBER OF TIMES ABOVE THE 24 HR. CRITERION  
(VALUES EXPRESSED IN MICROGRAMS/METER<sup>3</sup>)

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<u>Year</u>	<u>No. of Samples</u>	<u>Max. 24 Hr. Reading (ug/m<sup>3</sup>)</u>	<u>Geometric Mean (ug/m<sup>3</sup>)</u>	<u>No. of Times Above 24 Hr. Criterion*</u>
1962	24	468	91	10
1963	46	254	116	22
1964	50	299	90	8
1965	41	259	95	15
1966	48	302	76	11
1967	40	282	68	11
1968	43	364	82	10
1969	38	625	74	9
1970	53	648	52	11
1971	28	222	55	3
1972	23	169	66	6
1973	37	289	60	6
1974	42	136	49	3
1975	24	117	41	NIL
	<u>537</u>			<u>125</u>

\* Ontario criterion: 24 Hr.: 120 ug/m<sup>3</sup>

1 Year: 60 ug/m<sup>3</sup> (geometric mean)

Table 25

SUMMARY OF THE HIGH VOLUME FILTER  
MEASUREMENTS AT SITE NO. 11 (LAND REGISTRY OFFICE)  
IN SAULT STE. MARIE FOR 1975  
(ALL VALUES IN MICROGRAMS/METER<sup>3</sup>)

Date	Total Suspended Particulate Matter	Cd	Cu	Fe	Ni	Pb	Zn
July 17	114	--	--	--	--	--	--
23	43	--	--	--	--	--	--
29	95	ND	.16	4.0	ND	1.4	.60
Aug. 4	60	ND	.11	2.2	ND	.20	.40
10	55	ND	.12	2.3	ND	.20	.50
22	44	ND	.06	1.6	ND	.50	.10
28	55	ND	.03	2.2	ND	.50	.10
Sept. 3	51	ND	.03	3.0	ND	.50	.50
9	130	.001	.07	5.1	ND	.80	.80
27	146	ND	.15	9.9	.04	1.7	.30
Oct. 3	70	ND	.07	4.0	.03	.90	.10
21	113	.01	.79	14.4	.03	1.6	.50
27	62	ND	.54	1.4	.03	.70	.10
Nov. 2	58	ND	.43	1.4	.02	.60	.10
8	64	ND	.36	5.8	ND	1.0	.20
14	52	ND	.47	2.2	ND	1.3	.10
20	26	ND	.42	0.5	ND	.30	.10
26	48	ND	.60	0.8	ND	.20	.10
Dec. 2	32	.002	.66	1.3	.02	1.1	.10
8	59	.001	.64	1.9	.02	.70	.10
14	32	.003	.55	1.9	.03	.60	.10
20	26	.001	.48	0.5	.02	.80	.10
26	16	ND	.58	0.1	.02	.40	ND

Table 26

SUMMARY OF THE HIGH VOLUME FILTER  
MEASUREMENTS AT SITE NO. 12 (BONNEY STREET)  
IN SAULT STE. MARIE FOR 1975  
(ALL VALUES IN MICROGRAMS/METER<sup>3</sup>)

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Date	Total Suspended Particulate Matter
<hr/>	
July 12	196
15	287
17	415
20	62
22	104
24	54
26	146
29	207
31	220
Aug. 2	136
6	53
8	354
10	135
12	276
14	54
16	100
19	48
21	161
23	169
26	69
30	120
Sept. 2	34
4	36
6	22
11	23
13	24
16	66
18	311
20	134
23	54
25	82
27	92
30	144
Oct. 2	118
4	153
7	195
16	26
18	60
21	160
23	249
25	72
28	56
30	252
Nov. 4	353
6	353
8	55



Table 26 Cont'd

SUMMARY OF THE HIGH VOLUME FILTER  
MEASUREMENTS AT SITE NO. 12 (BONNEY STREET)  
IN SAULT STE. MARIE FOR 1975  
(ALL VALUES IN MICROGRAMS/METER<sup>3</sup>)

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Date	Total Suspended Particulate Matter
Nov. 11	35
13	36
16	82
18	146
20	60
22	37
26	20
27	35
29	419
Dec. 2	41
4	215
6	116
8	44
11	13
15	187
18	31
20	52
23	10

Table 27

SUMMARY OF THE HIGH VOLUME FILTER ANALYSIS BY ATOMIC ABSORPTION  
AT SITE NO. 10 (PROVINCE OF ONTARIO BUILDING)  
IN SAULT STE. MARIE FROM 1969 TO 1975  
(ALL VALUES IN MICROGRAMS/METER<sup>3</sup>)

<u>Year</u>	<u>Element</u>	<u>No. of Samples Analyzed</u>	<u>Max. 24 Hr Value (ug/m<sup>3</sup>)</u>	<u>O.M.E. Criterion For 24 Hr. (ug/m<sup>3</sup>)</u>
1973	Be	1	0.0	0.01
1971	Cd	17	0.03	2.0
1972		20	0.18	
1973		25	0.01	
1975		4	0.0	
1969	Ca	30	6.5	No criterion
1970		6	15.7	
1969	Cu	30	1.2	50
1970		6	1.8	
1971		17	0.9	
1972		20	0.3	
1973		25	0.3	
1969	Fe	30	12.2	No criterion
1970		6	8.1	
1971		17	7.7	
1972		20	11.0	
1973		24	6.7	
1969	Pb	30	2.7	5.0
1970		6	4.3	
1971		17	1.1	
1972		20	1.9	
1973		36	5.9	
1974		40	1.3	
1975		23	1.4	
1969	Ni	30	0.15	2.0
1970		6	0.16	
1971		17	0.04	
1972		20	0.06	
1973		25	0.03	
1975	Mn	4	0.46	50
1973	Se	1	0.0	No criterion
1973	Ag	1	0.0	1.0
1975	Vn	4	0.01	2.0
1969	Zn	30	0.7	No criterion
1970		6	0.7	
1971		15	0.5	
1972		20	0.5	
1973		24	0.8	

Table 28

SUMMARY OF HIGH VOLUME FILTER ANALYSIS FOR BENZO-A-PYRENE (BaP)  
AND BENZO-K-FLUORANTHENE (BkF) AT SITE NO. 10  
(PROVINCE OF ONTARIO BUILDING ) IN SAULT STE. MARIE FROM 1971 TO 1975  
(ALL VALUES IN MICROGRAMS/1000 METER<sup>3</sup>)

<u>Date</u>	<u>Benzo-A-Pyrene (BaP)</u> <u>(ug/1000 m<sup>3</sup>)</u>	<u>Benzo-K-Fluoranthene (BkF)</u> <u>(ug/1000 m<sup>3</sup>)</u>
<u>1971</u>		
July 4	0.09	0.09
12	0.06	0.11
27	1.16	1.03
August 12	0.34	0.58
September 15	0.44	0.19
21	0.44	0.81
December 2	0.29	0.16
10	0.14	0.33
18	0.12	0.19
<u>1972</u>		
January 11	0.02	0.26
March 6	0.86	2.18
14	0.09	0.22
31	0.10	0.26
April 8	0.33	0.38
24	0.79	0.72
May 2	0.05	0.09
June 3	0.11	0.34
20	0.07	0.14
27	0.54	0.58
July 13	0.08	0.18
October 10	22.5	34.0
25	0.58	0.62
November 18	1.08	0.84

... Cont'd 2

Table 28 Cont'd

SUMMARY OF HIGH VOLUME FILTER ANALYSIS FOR BENZO-A-PYRENE (BaP)  
AND BENZO-K-FLUORANTHENE (BkF) AT SITE NO. 10  
(PROVINCE OF ONTARIO BUILDING) IN SAULT STE. MARIE FROM 1971 TO 1975  
(ALL VALUES IN MICROGRAMS/1000 METER<sup>3</sup>)

<u>Date</u>	<u>Benzo-A-Pyrene (BaP)</u> <u>(ug/1000 m<sup>3</sup>)</u>	<u>Benzo-K-Fluoranthene (BkF)</u> <u>(ug/1000 m<sup>3</sup>)</u>
<u>1973</u>		
January 5	0.19	0.48
21	0.12	0.32
February 6	0.16	0.47
22	0.15	0.37
March 2	0.14	0.24
April 3	0.10	0.14
19	0.17	0.23
May 5	1.80	11.3
29	0.14	0.55
June 14	0.61	1.57
30	0.05	0.23
July 16	0.39	1.04
August 1	0.14	0.07
25	0.25	0.19
September 10	0.34	1.49
26	0.23	0.36
October 12	0.20	0.39
November 13	0.15	0.13
29	0.13	0.62
December 23	0.29	0.25
<u>1974</u>		
January 16	0.28	0.22
24	0.20	0.49

... Cont'd 3

Table 28 Cont'd

SUMMARY OF HIGH VOLUME FILTER ANALYSIS FOR BENZO-A-PYRENE (BaP)  
AND BENZO-K-FLUORANTHENE (BkF) AT SITE NO. 10  
(PROVINCE OF ONTARIO BUILDING) IN SAULT STE. MARIE FROM 1971 TO 1975  
(ALL VALUES IN MICROGRAMS/1000 METER<sup>3</sup>)

Date	Benzo-A-Pyrene (BaP) (ug/1000 m <sup>3</sup> )	Benzo-K-Fluoranthene (BkF) (ug/1000 m <sup>3</sup> )
February 9	3.89	5.22
March 5	0.27	0.48
13	1.01	1.31
18	0.24	0.88
24	0.35	0.85
30	0.24	0.52
April 5	3.33	5.49
17	1.00	1.51
23	0.13	0.42
May 5	0.16	0.16
13	0.06	0.48
23	0.40	1.20
29	0.47	0.97
June 11	0.15	0.49
17	0.25	1.20
24	0.04	0.34
July 4	0.24	0.65
18	0.12	0.13
26	0.09	0.19
August 15	0.04	0.09
27	0.01	0.45
September 8	0.09	0.35
18	0.27	0.46
October 2	0.09	0.19
10	0.09	0.29
16	0.12	0.08
December 7	0.10	0.20
19	0.02	0.02

... Cont'd 4

Table 28 Cont'd

SUMMARY OF HIGH VOLUME FILTER ANALYSIS FOR BENZO-A-PYRENE (BaP)  
AND BENZO-K-FLUORANTHENE (BkF) AT SITE NO. 10  
(PROVINCE OF ONTARIO BUILDING) IN SAULT STE. MARIE FROM 1971 TO 1975  
(ALL VALUES IN MICROGRAMS/1000 METER<sup>3</sup>)

<u>Date</u>	<u>Benzo-A-Pyrene (BaP)</u> <u>(ug/1000 m<sup>3</sup>)</u>	<u>Benzo-K-Fluoranthene (BkF)</u> <u>(ug/1000 m<sup>3</sup>)</u>
<u>1975</u>		
January 12	0.18	0.07
24	0.12	0.40
31	0.42	0.47
February 5	0.27	0.14
11	0.33	0.55
21	0.16	0.13
March 19	1.28	1.60
31	0.15	0.42
April 6	0.73	0.64
June 11	0.25	0.42
17	0.19	0.21
23	0.01	0.28
29	0.25	0.07
July 5	0.14	0.35
11	0.09	0.30

Table 29

SUMMARY OF THE HIGH VOLUME FILTER ANALYSIS FOR  
 BENZO-A-PYRENE (BaP) AND BENZO-K-FLUORANTHENE (BkF)  
 AT SITE NO. 11 (LAND REGISTRY OFFICE) IN SAULT STE. MARIE FOR 1975  
 (ALL VALUES IN MICROGRAMS/1000 METER<sup>3</sup>)

<u>Date</u>	<u>Benzo-A-Pyrene (BaP)</u> <u>(ug/1000 m<sup>3</sup>)</u>	<u>Benzo-K-Fluoranthene (BkF)</u> <u>(ug/1000 m<sup>3</sup>)</u>
July 29	0.14	0.44
August 4	0.35	0.63
10	0.03	0.12
September 27	1.61	2.32
October 3	1.30	2.42
21	2.15	5.07
November 2	0.11	0.46
14	0.38	0.96
26	0.46	0.93
December 8	0.24	0.52
20	0.19	0.62

Table 30

SUMMARY OF THE HIGH VOLUME FILTER ANALYSIS FOR BENZO-A-PYRENE (BaP)  
AND BENZO-K-FLUORANTHENE (BkF) AT SITE  
NO. 12 (BONNEY STREET) IN SAULT STE. MARIE FOR 1975  
(ALL VALUES IN MICROGRAMS/1000 METER<sup>3</sup>)

<u>Date</u>	<u>Benzo-A-Pyrene (BaP)</u> <u>(ug/1000 m<sup>3</sup>)</u>	<u>Benzo-K-Fluoranthene (BkF)</u> <u>(ug/1000 m<sup>3</sup>)</u>
July 12	21.4	35.2
24	13.5	16.1
August 6	0.18	0.42
19	1.01	1.23
30	4.31	5.75
September 11	0.07	0.21
23	1.02	1.01
October 4	58.3	85.3
16	0.23	0.48
28	0.47	0.59
November 8	1.06	0.87
20	1.69	2.39
December 2	2.73	2.54
15	56.3	56.8
23	0.14	0.28



Table 31

RESULTS OF THE SPECIAL ANALYSIS FOR BaP AND BkF LEVELS  
IN THE VICINITY OF THE ALGOMA STEEL CO. IN SAULT STE. MARIE DURING 1975  
(ALL VALUES IN MICROGRAMS/1000 METER<sup>3</sup>)

<u>Date</u>	<u>Filter No.</u>	<u>BaP (ug/1000 m<sup>3</sup>)</u>	<u>BkF (ug/1000 m<sup>3</sup>)</u>
January 24	51*	152.0	216.0
	52	43.2	61.6
	28	53	13.2
	54	0.21	20.3
	29	56	0.39
	30	57	11.2
	31	59	0.56
February 1	61	0.22	0.96
	62	0.22	0.25
	3	13	1.38
	14	31.8	5.59
	4	65	2.61
	66	27.7	43.0

\* This filter was exposed to only 1/10 of the regular air volume normally sampled during the customary 24 hr. sampling period.

Table 32

SUMMARY OF THE COEFFICIENT OF HAZE READINGS  
 AT SITE NO. 10 (PROVINCE OF ONTARIO BUILDING) IN SAULT STE. MARIE FOR 1970 TO 1975  
 (ALL VALUES IN COH UNITS/1000 LINEAR FT. OF AIR)

---

<u>Year</u>	<u>Max. 2 Hr. Value</u>	<u>Max. 24 Hr. Avg.</u>	<u>Annual Avg.</u>	<u>Number of Times Above Criterion*</u>	
				<u>24 Hr.</u>	<u>1 Yr.</u>
1970	2.0 (Oct.)	0.9 (Oct.)	0.31	NIL	NIL
1971	2.3 (June)	0.8 (Jan.)	0.28	NIL	NIL
1972	2.3 (Aug.)	0.9 (Mar.)	0.36	NIL	NIL
1973	3.3 (Jan.)	1.0 (Jan., Feb.)	0.20	NIL	NIL
1974	1.9 (Apr.)	0.7 (Feb.)	0.23	NIL	NIL
1975	2.0 (June)	0.3 (Jan., June)	0.13	NIL	NIL

\* 24 Hr. Criterion: 1.0 COH

1 Yr. Criterion: 0.5 COH

Table 33

AVERAGE MONTHLY COEFFICIENT OF HAZE LEVELS  
AT THE PROVINCE OF ONTARIO BUILDING IN SAULT STE. MARIE FOR 1970 TO 1975  
(ALL VALUES IN COH UNITS/1000 LINEAR FT. OF AIR)

---

Year	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1970	--	--	--	--	--	--	--	.23	.29	.42	--	.45
1971	.36	.41	.32	--	.35	.35	.23	.22	.24	.30	.21	.12
1972	.26	--	.45	.35	.45	--	.21	.34	.34	.36	.37	.38
1973	.44	.31	.16	.15	.21	.19	.21	.18	.17	.18	--	--
1974	.28	.32	.25	.22	.19	.23	.25	.20	.22	.24	.17	.18
1975	<u>.14</u>	<u>.12</u>	<u>.10</u>	<u>--</u>	<u>--</u>	<u>.17</u>	<u>.13</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>
MEAN	.30	.29	.26	.24	.30	.24	.21	.23	.25	.30	.25	.28

Table 34

ANNUAL HOURLY AVERAGE COH VALUES RECORDED AT  
THE PROVINCE OF ONTARIO BUILDING IN SAULT STE. MARIE FOR 1970 TO 1975  
(ALL VALUES IN COH UNITS/1000 LINEAR FT. OF AIR)

---

<u>Year</u>	<u>0200</u>	<u>0400</u>	<u>0600</u>	<u>0800</u>	<u>1000</u>	<u>1200</u>	<u>1400</u>	<u>1600</u>	<u>1800</u>	<u>2000</u>	<u>2200</u>	<u>2400</u>
1970	0.35	0.33	0.30	0.38	0.35	0.28	0.33	0.28	0.33	0.33	0.38	0.48
1971	0.34	0.26	0.30	0.30	0.26	0.26	0.22	0.26	0.26	0.33	0.33	0.36
1972	0.36	0.31	0.32	0.37	0.36	0.30	0.29	0.33	0.39	0.39	0.36	0.36
1973	0.18	0.23	0.21	0.22	0.20	0.21	0.20	0.22	0.26	0.20	0.23	0.23
1974	0.23	0.20	0.20	0.25	0.25	0.22	0.19	0.20	0.22	0.26	0.23	0.24
1975	<u>0.12</u>	<u>0.14</u>	<u>0.10</u>	<u>0.12</u>	<u>0.16</u>	<u>0.10</u>	<u>0.10</u>	<u>0.10</u>	<u>0.12</u>	<u>0.14</u>	<u>0.16</u>	<u>0.14</u>
MEAN	0.26	0.25	0.24	0.27	0.26	0.23	0.22	0.23	0.26	0.28	0.28	0.30

Table 35

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT SITE NO. 1  
(BEAVER HOTEL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1970	--	--	--	--	--	--	.11	--	.36	.34	.31	.60	.34
1971	.72	.39	.39	.31	.30	.11	.23	.19	.20	.27	.37	.67	.35
1972	.43	.40	.25	.37	.17	.12	.11	.08	.25	.29	.39	.53	.28
1973	.30	.21	--	--	.14	.10	.18	.45	.19	.47	.16	.22	.24
1974	.13	.23	.49	.21	.20	.15	.21	.24	.21	.06	.71	.27	.26
1975	<u>.41</u>	<u>.44</u>	<u>.30</u>	<u>.28</u>	<u>.17</u>	<u>.19</u>	<u>.20</u>	<u>.21</u>	<u>.23</u>	<u>.41</u>	<u>.49</u>	<u>.36</u>	.31
MEAN	.40	.33	.36	.29	.20	.13	.17	.23	.24	.31	.41	.44	.29

Table 36

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
 SITE NO. 2 (ANNA McREA PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
 (ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	.05	.03	.07	.16	.17	.43	.15
1971	.26	.34	.34	.17	.18	.11	.08	.08	.06	.14	.14	.21	.18
1972	.26	.33	.14	.17	.18	.07	.05	.05	.07	.11	.15	.25	.15
1973	.15	.14	.15	--	.07	.02	.04	.21	.06	.14	.02	.10	.10
1974	.03	.16	.18	.13	.17	.10	.09	.09	--	.16	.16	.12	.13
1975	<u>.19</u>	<u>.14</u>	<u>.15</u>	<u>.09</u>	<u>.10</u>	<u>.14</u>	<u>.10</u>	<u>.08</u>	<u>.08</u>	<u>.11</u>	<u>.15</u>	<u>.22</u>	.13
MEAN	.18	.22	.19	.14	.14	.09	.07	.09	.07	.14	.13	.22	.14

Table 37

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
SITE NO. 3 (JAMES LYONS PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	--	.06	.07	--	.18	.40	.18
1971	.25	.26	.26	.15	.15	.12	.08	.11	.08	.12	.14	.18	.16
1972	.18	.29	.13	.11	.15	.11	.04	.05	.06	.23	.13	.20	.14
1973	.13	.15	.16	--	.06	.08	.06	.27	.08	.11	.11	.10	.12
1974	.00	.12	.21	.11	.15	.24	.08	.11	.10	.18	.14	.14	.13
1975	<u>.20</u>	<u>.12</u>	<u>.13</u>	<u>--</u>	<u>--</u>	<u>.12</u>	<u>.14</u>	<u>.09</u>	<u>.09</u>	<u>.12</u>	<u>.12</u>	<u>.26</u>	.14
MEAN	.15	.19	.18	.12	.13	.13	.08	.12	.08	.15	.14	.21	.14

Table 38

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT SITE  
NO. 4 (ALEXANDER HENRY HIGH SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

---

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	.05	--	.09	.29	.31	.49	.25
1971	.25	.31	.31	.14	.15	.15	.05	.11	.19	.42	.27	.42	.23
1972	.40	.38	.20	.18	.25	.08	.04	.07	.24	.40	.22	.33	.23
1973	.30	.31	.32	--	.11	--	.05	.05	.20	.17	.05	.15	.17
1974	.00	.22	.30	.16	.22	.05	.08	.10	.12	.27	.32	.20	.17
1975	<u>.27</u>	<u>.17</u>	<u>.12</u>	<u>.11</u>	<u>.14</u>	<u>.13</u>	<u>.10</u>	<u>--</u>	<u>--</u>	<u>.17</u>	<u>.12</u>	<u>.26</u>	.16
MEAN	.24	.28	.25	.15	.17	.10	.06	.08	.17	.29	.22	.31	.20



Table 39

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT SITE  
NO. 5 (BAYVIEW PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

---

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	---	--	--	.11	.14	.38	.77	.59	.44	.41
1971	.51	.44	.44	.29	.28	.22	.18	.26	.34	.46	.37	.41	.35
1972	.61	.52	.35	.24	.33	.19	.17	.16	.41	.35	.26	.35	.33
1973	.38	.41	.23	--	.34	.25	.15	.68	.34	.38	.34	.18	.33
1974	.09	.54	.44	.30	.30	.10	.13	.34	.24	.34	.34	.38	.30
1975	<u>.38</u>	<u>.22</u>	<u>.34</u>	<u>.42</u>	<u>.23</u>	<u>.45</u>	<u>.32</u>	<u>.21</u>	<u>.34</u>	<u>.54</u>	<u>.58</u>	<u>.60</u>	.39
MEAN	.39	.43	.36	.31	.30	.24	.18	.30	.34	.47	.41	.39	.34

Table 40

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
AT SITE NO. 6 (HOLY ANGELS SEPARATE SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	.10	.08	.16	.29	.35	.42	.23
1971	.54	.35	.35	.24	.24	.14	.11	.09	.09	.21	.21	.36	.24
1972	.33	.43	.28	.17	.17	.05	.06	.08	.13	.29	.38	.40	.23
1973	.27	.29	--	--	.13	.10	.10	.38	.15	.24	.16	.18	.20
1974	.00	.27	.30	.17	.21	.11	.11	.14	.14	.24	.34	.23	.19
1975	<u>.30</u>	<u>.28</u>	<u>.19</u>	<u>.18</u>	<u>.16</u>	<u>.16</u>	<u>.14</u>	<u>.09</u>	<u>.13</u>	<u>.23</u>	<u>.23</u>	<u>.29</u>	.20
MEAN	.29	.32	.28	.19	.18	.11	.10	.14	.13	.25	.28	.31	.21

Table 41

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
AT SITE NO. 7 (OUR LADY OF LOURDES SEPARATE SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	.05	.07	.08	.22	.26	.40	.18
1971	.24	.14	.14	.13	.13	.11	.07	.09	.08	.24	.15	.20	.14
1972	.22	.36	.18	.14	.17	.15	.07	.05	.08	.32	.17	.22	.17
1973	.18	.18	--	--	.09	.10	.07	.28	.04	.12	.11	.13	.13
1974	.03	.14	.23	.12	.15	.07	.09	.14	.10	.21	.19	.16	.14
1975	<u>.25</u>	<u>.14</u>	<u>.14</u>	<u>.12</u>	<u>.11</u>	<u>.13</u>	<u>.12</u>	<u>.08</u>	<u>.09</u>	<u>.18</u>	<u>.12</u>	<u>.31</u>	.15
MEAN	.18	.19	.17	.13	.13	.09	.08	.12	.08	.22	.17	.24	.15

Table 42

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
SITE NO. 8 (FRANKLIN STREET PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1970	--	--	--	--	--	--	.09	.12	.13	.26	.27	.39	.21
1971	.36	.32	.32	.21	.22	.14	.17	.16	.13	.24	.22	.29	.23
1972	.29	.38	.22	.17	.21	.08	.10	.09	.10	.33	.23	.34	.21
1973	.23	.22	.15	--	.09	.11	--	.40	.09	.15	.17	.15	.18
1974	.00	.23	.26	.13	.15	.10	.11	.15	.13	.26	.19	.00	.14
1975	<u>.48</u>	<u>.18</u>	<u>.14</u>	<u>.15</u>	<u>.13</u>	<u>.20</u>	<u>.23</u>	<u>.14</u>	<u>.16</u>	<u>.21</u>	<u>.22</u>	<u>.31</u>	.21
MEAN	.27	.27	.22	.17	.16	.13	.14	.18	.12	.24	.22	.25	.20

Table 43

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
SITE NO. 9 ( S. F. HOWE PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1970	--	--	--	--	--	--	.09	.05	--	.23	.32	.44	.23
1971	.43	.36	.36	.13	.13	.18	.10	.11	.12	.21	.27	.35	.23
1972	.33	.39	.22	.18	.18	.08	.06	.05	.12	.41	.29	.42	.23
1973	.26	.30	--	--	.08	.06	--	.31	.12	.15	.10	.28	.18
1974	.00	.23	.24	.13	.16	.10	.10	.11	.11	.25	.31	.22	.16
1975	<u>.39</u>	<u>.22</u>	<u>.17</u>	<u>.14</u>	<u>.11</u>	<u>.13</u>	<u>.10</u>	<u>.07</u>	<u>.12</u>	<u>.20</u>	<u>.09</u>	<u>.17</u>	.16
MEAN	.28	.30	.25	.15	.13	.11	.09	.12	.12	.24	.23	.31	.20

Table 44

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
SITE NO. 10 (PROVINCE OF ONTARIO BUILDING) IN SAULT STE. MARIE FROM 1970 TO 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

---

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1970	--	--	--	--	--	--	.07	.13	.22	.25	.46	.41	.26
1971	.43	.41	.41	.05	.05	.21	.17	.14	.23	.21	.37	.31	.25
1972	.33	.54	.29	.02	.32	.18	.12	.09	.27	.25	.31	.42	.26
1973	.35	.28	.25	--	.24	.11	--	.53	.18	.33	.17	.19	.26
1974	.00	.32	.34	.21	.21	.10	.13	.15	.16	.28	.22	.21	.19
1975	<u>.26</u>	<u>.28</u>	<u>.18</u>	<u>.18</u>	<u>.15</u>	<u>.16</u>	<u>.14</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	<u>--</u>	.19
MEAN	.27	.37	.29	.12	.19	.15	.13	.21	.21	.26	.31	.31	.24

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Table 45

SULPHATION RATES ON THE LEAD PEROXIDE CANDLES AT  
SITE NO. 11 (LAND REGISTRY OFFICE) IN SAULT STE. MARIE FOR 1975  
(ALL VALUES IN MGM SO<sub>3</sub>/100 CM<sup>2</sup>/DAY)

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Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean
1975	--	--	--	--	--	--	--	.12	.11	.25	.22	.27	.19

Table 46

ANNUAL MEAN SULPHATION RATES AND THE NUMBER OF TIMES ABOVE  
THE CRITERION FOR LOCATIONS IN SAULT STE. MARIE FROM 1970 TO 1975

Site No.	Annual Mean Rates (mgm SO <sub>3</sub> /100 cm <sup>2</sup> /day)						No. of Times Above the Criterion*						Total	
	1970	1971	1972	1973	1974	1975	1970	1971	1972	1973	1974	1975		
1	.34 <sup>5</sup>	.35	.28	.24	.26	.31	NIL	1	NIL	NIL	1	NIL	2	
2	.15 <sup>6</sup>	.18	.15	.10 <sup>11</sup>	.13 <sup>11</sup>	.13	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
3	.18 <sup>4</sup>	.16	.14	.12 <sup>11</sup>	.13	.14 <sup>10</sup>	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
4	.25 <sup>5</sup>	.23	.23	.17 <sup>10</sup>	.17	.16 <sup>10</sup>	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
5	.41 <sup>6</sup>	.35	.33	.33 <sup>11</sup>	.30	.39	1	NIL	NIL	NIL	NIL	NIL	1	
6	.23 <sup>6</sup>	.24	.23	.20 <sup>10</sup>	.19	.20	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
7	.18 <sup>6</sup>	.14	.17	.13 <sup>10</sup>	.14	.15	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
8	.21 <sup>6</sup>	.23	.21	.18 <sup>10</sup>	.14	.21	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
9	.23 <sup>5</sup>	.23	.23	.18 <sup>9</sup>	.16	.16	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
10	.26 <sup>6</sup>	.25	.26	.26 <sup>10</sup>	.19	.19 <sup>7</sup>	NIL	NIL	NIL	NIL	NIL	NIL	NIL	
11	--	--	--	--	--	.19 <sup>5</sup>	--	--	--	--	--	NIL	NIL	
MEAN	.24	.24	.22	.19	.18	.20	TOTAL	1	1	NIL	NIL	1	NIL	3

\* Ontario Criterion: (current)

0.7 mgm SO<sub>3</sub>/100 cm<sup>2</sup>/day (30 day period)

Table 47

FLUORIDATION RATES ON LIME CANDLES AT  
SITE NO. 1 (BEAVER HOTEL) IN SAULT STE. MARIE FROM 1971 TO 1975  
(ALL VALUES IN MICROGRAMS F/100 CM<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1971	--	--	--	--	--	--	--	19	25	--	30	170	61
1972	110	16	35	0	25	17	27	15	24	17	70	27	32
1973	20	26	12	--	15	47	--	31	32	38	10	--	26
1974	15	34	19	23	30	17	19	16	21	26	11	18	21
1975	<u>8</u>	<u>14</u>	<u>22</u>	<u>32</u>	<u>16</u>	<u>17</u>	<u>41</u>	<u>61</u>	<u>43</u>	<u>37</u>	<u>40</u>	<u>41</u>	31
MEAN	38	23	22	18	22	25	29	28	29	30	32	64	30

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Table 48

FLUORIDATION RATES ON LIME CANDLES AT  
 SITE NO. 5 (BAYVIEW PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1971 TO 1975  
 (ALL VALUES IN MICROGRAMS F/100 CM<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1971	--	--	--	--	--	--	--	--	16	--	33	100	50
1972	100	25	35	7	22	22	18	20	23	40	9	37	30
1973	29	27	12	--	41	50	--	100	32	27	35	--	39
1974	20	34	16	25	6	34	12	27	17	31	34	18	23
1975	<u>12</u>	<u>4</u>	<u>29</u>	<u>41</u>	<u>18</u>	<u>42</u>	<u>28</u>	<u>80</u>	<u>40</u>	<u>37</u>	<u>46</u>	<u>40</u>	35
MEAN	40	23	23	24	22	37	19	57	26	34	31	49	32

Table 49

FLUORIDATION RATES ON LIME CANDLES AT  
SITE NO. 7 (OUR LADY OF LOURDES SEPARATE SCHOOL) IN SAULT STE. MARIE FROM 1971 TO 1975  
(ALL VALUES IN MICROGRAMS F/100 CM<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1971	--	--	--	--	--	--	--	13	12	--	18	32	19
1972	33	14	22	6	17	17	13	7	15	25	12	17	17
1973	29	17	15	--	11	10	--	44	13	15	4	--	18
1974	18	22	13	10	24	52	16	5	7	16	6	9	17
1975	--	16	9	8	5	8	11	60	19	10	10	9	15
MEAN	27	17	15	8	14	22	13	26	13	17	10	17	17

Table 50

FLUORIDATION RATES ON LIME CANDLES AT  
 SITE NO. 8 (FRANKLIN STREET PUBLIC SCHOOL) IN SAULT STE. MARIE FROM 1971 TO 1975  
 (ALL VALUES IN MICROGRAMS F/100 CM<sup>2</sup>/30 DAYS)

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<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1971	--	--	--	--	--	--	--	16	14	--	18	20	17
1972	15	16	22	4	17	22	20	20	12	11	30	25	17
1973	12	24	9	--	15	21	--	50	13	15	4	--	18
1974	15	25	21	8	9	11	19	8	24	16	6	9	14
1975	8	10	9	--	--	--	30	49	27	12	--	10	19
MEAN	13	19	15	6	14	18	23	20	18	14	15	16	17

Table 51

FLUORIDATION RATES ON LIME CANDLES AT  
SITE NO. 10 (PROVINCE OF ONTARIO BUILDING) IN SAULT STE. MARIE FROM 1971 TO 1975  
(ALL VALUES IN MICROGRAMS F/100 CM<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1971	--	--	--	--	--	--	--	19	34	--	17	29	25
1972	37	10	9	1	27	33	29	15	16	18	36	20	21
1973	23	19	6	--	15	16	--	55	16	18	7	--	19
1974	15	34	35	13	15	17	14	13	17	18	7	9	17
1975	6	12	8	11	6	11	17	--	--	--	--	--	10
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	
MEAN	20	19	15	8	16	19	20	26	21	18	17	19	17

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Table 52

FLUORIDATION RATES ON LIME CANDLES AT  
SITE NO. 11 (LAND REGISTRY OFFICE) IN SAULT STE. MARIE FOR 1975  
(ALL VALUES IN MICROGRAMS F/100 CM<sup>2</sup>/30 DAYS)

<u>Year</u>	<u>Jan.</u>	<u>Feb.</u>	<u>Mar.</u>	<u>Apr.</u>	<u>May</u>	<u>June</u>	<u>July</u>	<u>Aug.</u>	<u>Sept.</u>	<u>Oct.</u>	<u>Nov.</u>	<u>Dec.</u>	<u>Mean</u>
1975	--	--	--	--	--	--	--	38	26	18	17	18	23

Table 53

ANNUAL MEAN FLUORIDATION RATES AND THE NUMBER OF  
TIMES ABOVE THE CRITERION  
FOR LOCATIONS IN SAULT STE. MARIE FROM 1971 TO 1975

Site No.	Annual Mean Fluoridation Rates (ug F/100 cm <sup>2</sup> /30 days)					Number of Times Above the Criterion					Total
	1971	1972	1973	1974	1975	1971	1972	1973	1974	1975	
1	61 <sup>4</sup>	32	26 <sup>9</sup>	21	31	1	1	1	NIL	3	6
5	50 <sup>3</sup>	30	39 <sup>9</sup>	23	35	1	1	3	NIL	3	8
7	19 <sup>4</sup>	17	18 <sup>9</sup>	17	15 <sup>11</sup>	NIL	NIL	1	1	1	3
8	17 <sup>4</sup>	17	18 <sup>9</sup>	14	19 <sup>8</sup>	NIL	NIL	1	NIL	1	2
10	25 <sup>4</sup>	21	19 <sup>9</sup>	17	10 <sup>7</sup>	NIL	NIL	1	NIL	NIL	1
11	--	--	--	--	23 <sup>5</sup>	--	--	--	--	NIL	NIL
MEAN	34	23	24	18	22	TOTAL 2	2	7	1	8	20

\* Ontario Criterion: April 15 to October 15: 40 ug F/100 cm<sup>2</sup>/30 days  
 October 16 to April 14: 80 ug F/100 cm<sup>2</sup>/30 days



\*96936000009237\*